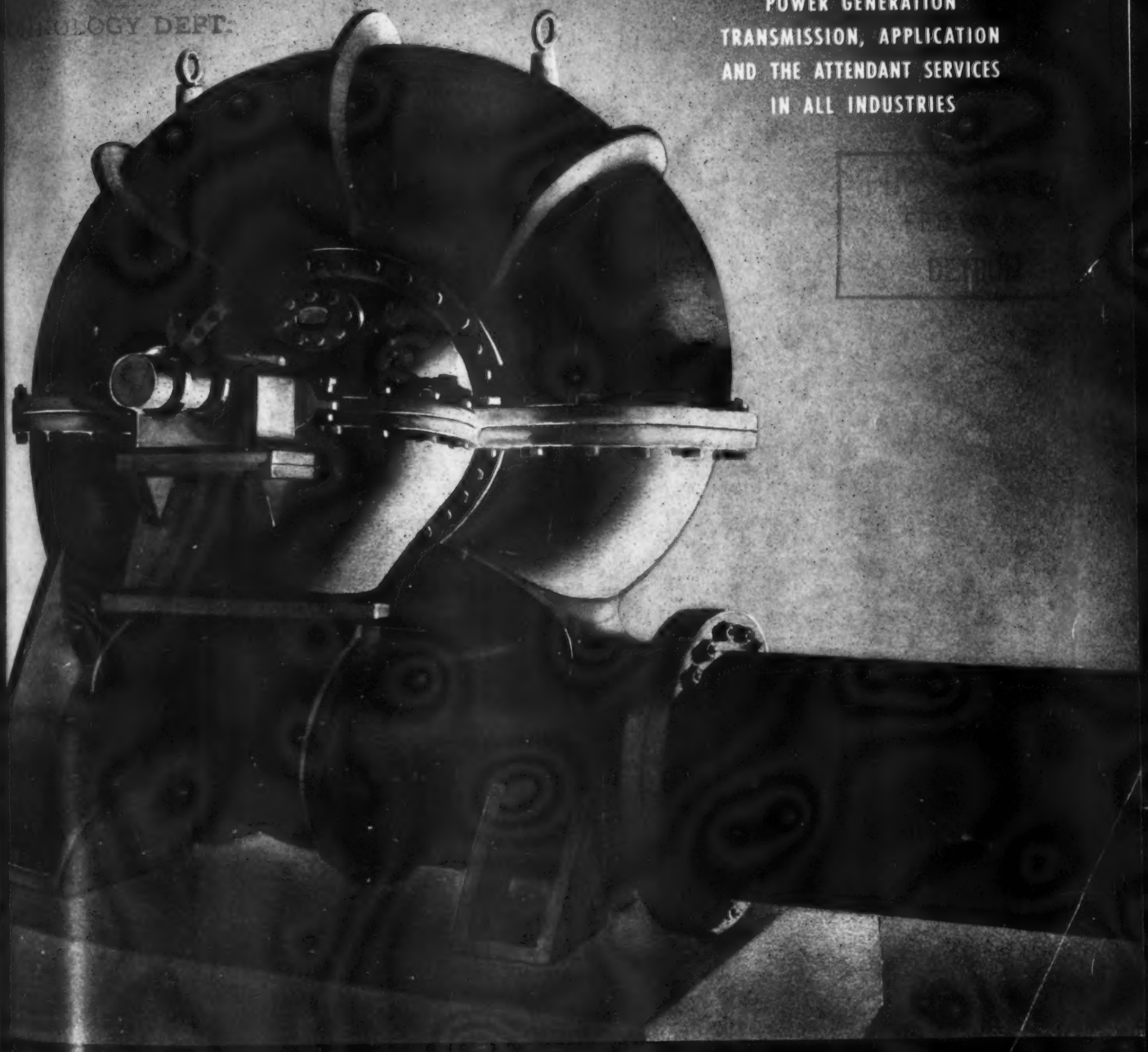
ONE OF A SERIES OF SUGGESTIONS TO AID PRODUCTION

POWER

BRUARY, 1943

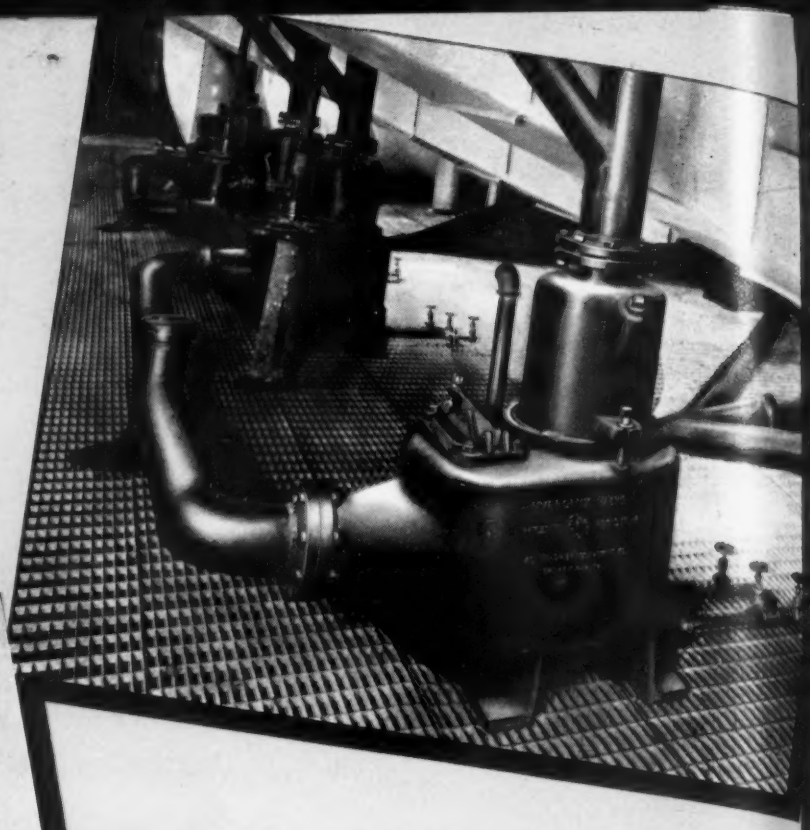
POWER GENERATION
TRANSMISSION, APPLICATION
AND THE ATTENDANT SERVICES
IN ALL INDUSTRIES

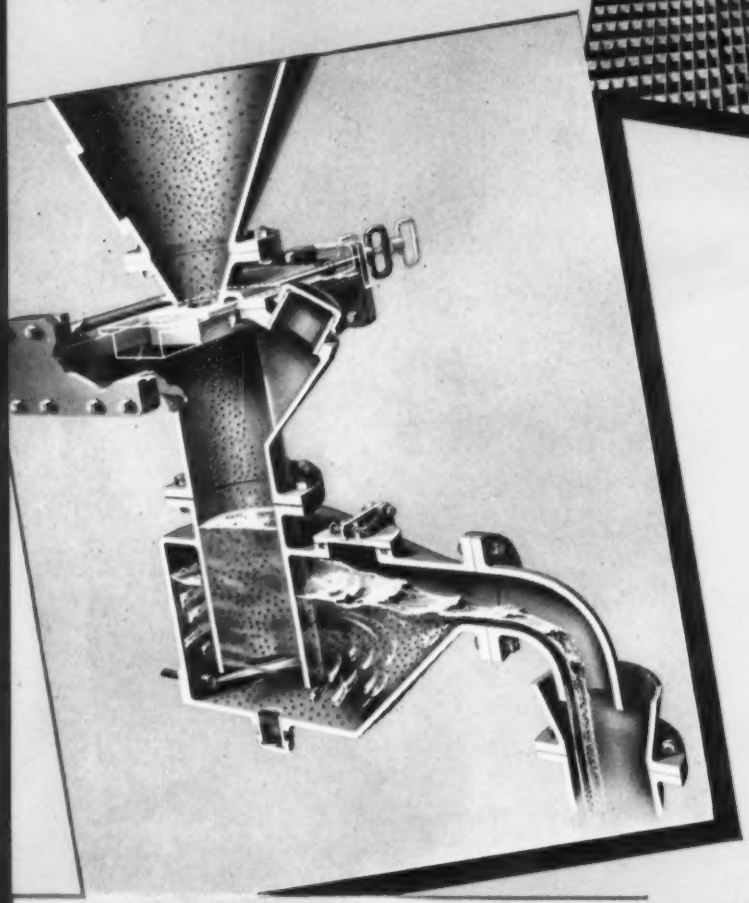


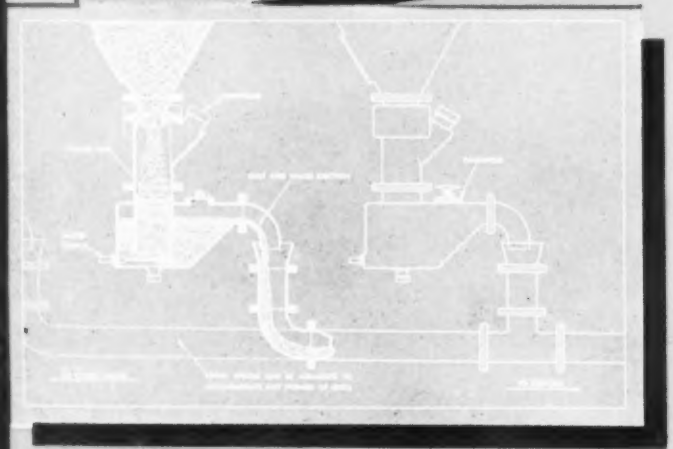
n this issue — PUMP MAINTENANCE, a 16-page Special Section

$75.00

SAVED DAILY BY HYDRO-MIXING DUST . . . . and PUMPING to fill







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No Moving Parts — No Dust

The Hydro-Mix Dust Valve is generally operated continuously, since an extremely small amount of low pressure water is used, per pound of dust handled. The dust from the collector or other pockets drops into the valve and is hydromixed; the mixture then flows by gravity or is pumped to lowlands for fill. Where these valves are applicable they represent the very minimum in initial investment, the lowest possible operating cost and practically maintenance-free service. . . . A large chemical plant recently selected the Hydro-Mix Dust System over a dry dust handling system because in addition to costing only about half as much to install, it saved $75.00 daily in operating costs for handling 200 tons of dust, ¾ mile to fill. Hydro-Mix Valves, a Hydroseal Pump and a 4" pipeline are used instead of special apparatus for mixing the dust with water, then loading into a truck and hauling to fill. . . . Catalog No. 1042 describes the valve and tells more about this chemical plant job. Write for it today.

HYDRO-MIX DUST VALVES

An Honestly Built Product can be operated too inexpensively to be priced expensively

ALLEN-SHERMAN-HOFF CO., 227 S. 15th St., PHILADELPHIA • Offices & Representatives in Principal Citi

POWER (with which are consolidated "Science and Industry," "The Engineer Review," "The Engineer," and "The Stationary Engineer"), February, 1943, Vol. 87, No. 2. Published monthly with an additional Directory number in December. McGraw-Hill Publishing Company, Inc., Publication office, 99-129 North Broadway, Albany, N. Y. Editorial and Executive offices, 330 West 42nd Street, New York, N. Y. Entered as second-class matter August 25, 1936, at Post Office, at Albany, N. Y., under the act of March 3, 1879. Printed in U. S. A. Allow at least ten days for change of address. All communications about subscriptions should be addressed to the Director of Circulation, 330 West 42nd Street, New York, N. Y. Subscription rates—U. S. and U. S. Possessions, $3.00 for one year, $4.00 for two years. Canada, $3.50 for one year, $5.00 for two years. Great Britain and British Possessions 36 shillings per year. All other countries, $6.00 for one year, $9.00 for two years, 35c per copy.

★ LET US HELP YOU ★

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ON THE PRODUCTION FRONT

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There are many types of conveyors available today and it is most important that the correct type be used for each application. Link-Belt manufactures them all—belt, trolley screw, Bulk-Flo, chain, apron, flight, bucket, etc.—all products of over a half century of experience in the engineering and manufacturing of equipment of this kind. A nation-wide staff of engineers is at your service.

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The maintenance of your mechanical power transmission equipment, in A-1 running order, is all important to maximum production efficiency. Link-Belt transmission experts, with a complete line of mounted and unmounted ball and roller and babbitted bearing units, clutches, couplings, collars, sprockets, shafting, etc., are ready and anxious to assist you.

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If you wish to cut costs and improve your drying operations, eliminate obsolete methods, save on heat and maintenance, you will be interested in the unique features of the Roto-Louvre dryer-cooler as described in special catalog and engineering data book No. 1911. It contains valuable information on the subject of drying and cooling. Send for a copy.

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FOR UNITY FOR VICTORY

● With industry on the offensive, all goes well only as long as your machine tools, material handling and preparation, mechanical transmission and power equipment are holding up . . . for the Nation's life depends on the productivity of this plant equipment.

Constant vigilance and an extra measure of lubrication, cleaning and adjustment will ward off breakdowns — conserve replacement parts — save priceless production time.

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Whether your problem is complex or simple, be sure and call on Link-Belt for help. Years of experience in the application and manufacture of a complete line of all types of screens—vibrating, shaking, rotary, conical, cylindrical, etc.—assure successful installations. Send for literature on any or all types.

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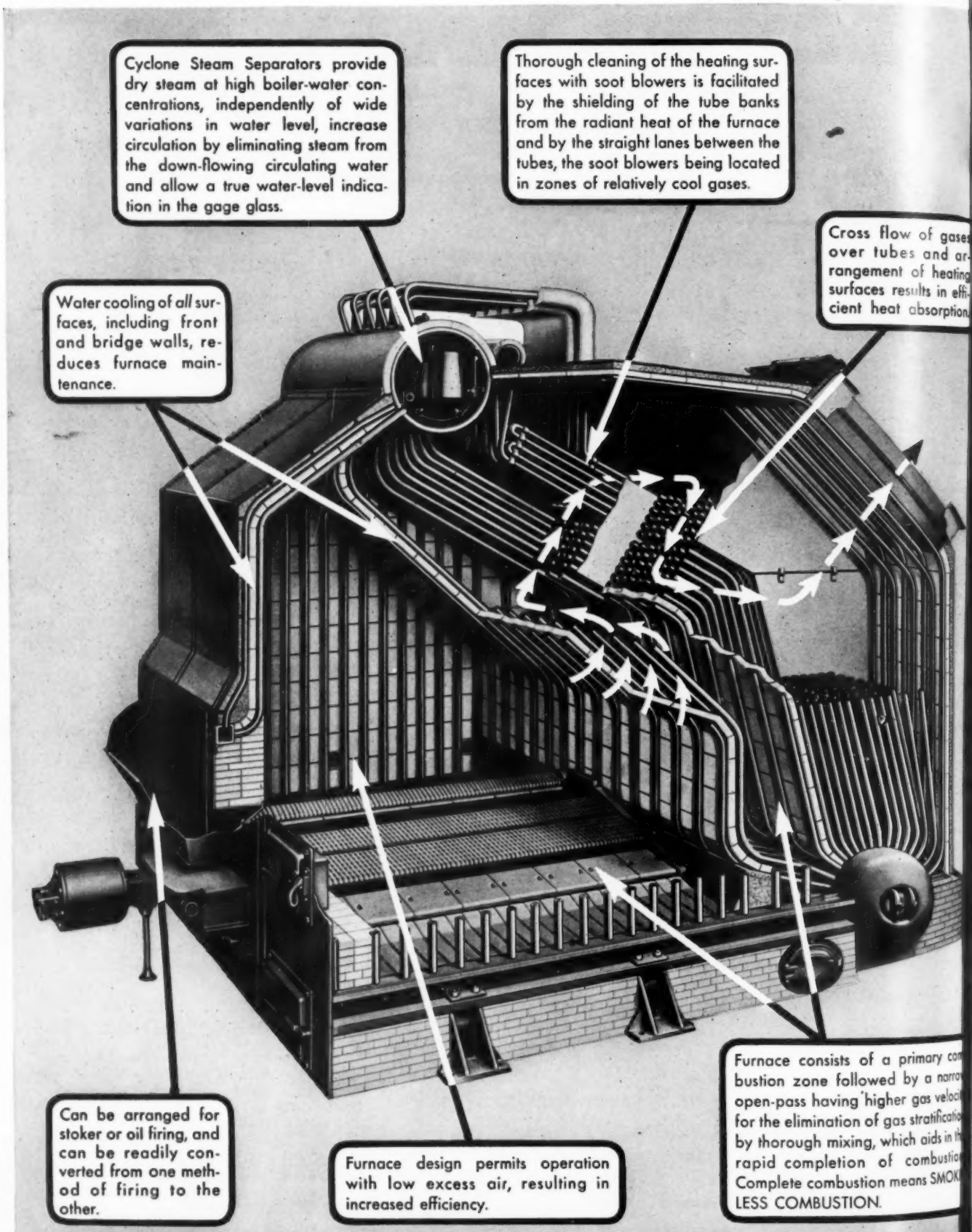
Getting coal to the fire and ashes away presents one of today's most fertile sources for conservation and increasing efficiency in power plant operation. A special Link-Belt Book, No. 1510, points the way with ideas and suggestions, and information on the proper application of the various types of mechanical handling equipment. Send for it today.

LINK-BELT

LET'S GO! U.S.A. KEEP 'EM FLYING!


Cyclone Steam Separators provide dry steam at high boiler-water concentrations, independently of wide variations in water level, increase circulation by eliminating steam from the down-flowing circulating water and allow a true water-level indication in the gage glass.
Thorough cleaning of the heating surfaces with soot blowers is facilitated by the shielding of the tube banks from the radiant heat of the furnace and by the straight lanes between the tubes, the soot blowers being located in zones of relatively cool gases.
Cross flow of gases over tubes and arrangement of heating surfaces results in efficient heat absorption.
Water cooling of *all* surfaces, including front and bridge walls, reduces furnace maintenance.
Can be arranged for stoker or oil firing, and can be readily converted from one method of firing to the other.
Furnace design permits operation with low excess air, resulting in increased efficiency.
Furnace consists of a primary combustion zone followed by a narrow open-pass having higher gas velocity for the elimination of gas stratification by thorough mixing, which aids in the rapid completion of combustion. Complete combustion means SMOKELESS COMBUSTION.

B & W INTEGRAL

Nearly 200 Units ordered by Small-Boiler Plants to secure these Large-Boiler Advantages

Plants requiring as low as 9000 lb. of steam per hour can now have the efficiency features indicated on the drawing and that were formerly available only in much larger boilers. Skillful engineering has incorporated these and other advantages in the design of the B&W Integral-Furnace Boiler in a way that maintains compactness, simplified operation, and low initial cost.

A large amount of water-cooled surface in the furnace permits wide variation in the grades of coal that can be burned successfully. Oil-fired units can be readily converted to stoker firing at small cost for brickwork changes.

Maintenance is reduced by complete water cooling of the furnace, which contains a minimum of unprotected brickwork. Even the upper front wall and roof are water cooled, as well as the bridge wall and side walls.

All pressure parts are readily accessible for inspection and cleaning. All the header handholes are accessible from outside the boiler. The steam-drum internal fittings are easily removed when necessary. The steel casing facilitates good housekeeping.

THE BABCOCK & WILCOX COMPANY
85 LIBERTY STREET, NEW YORK

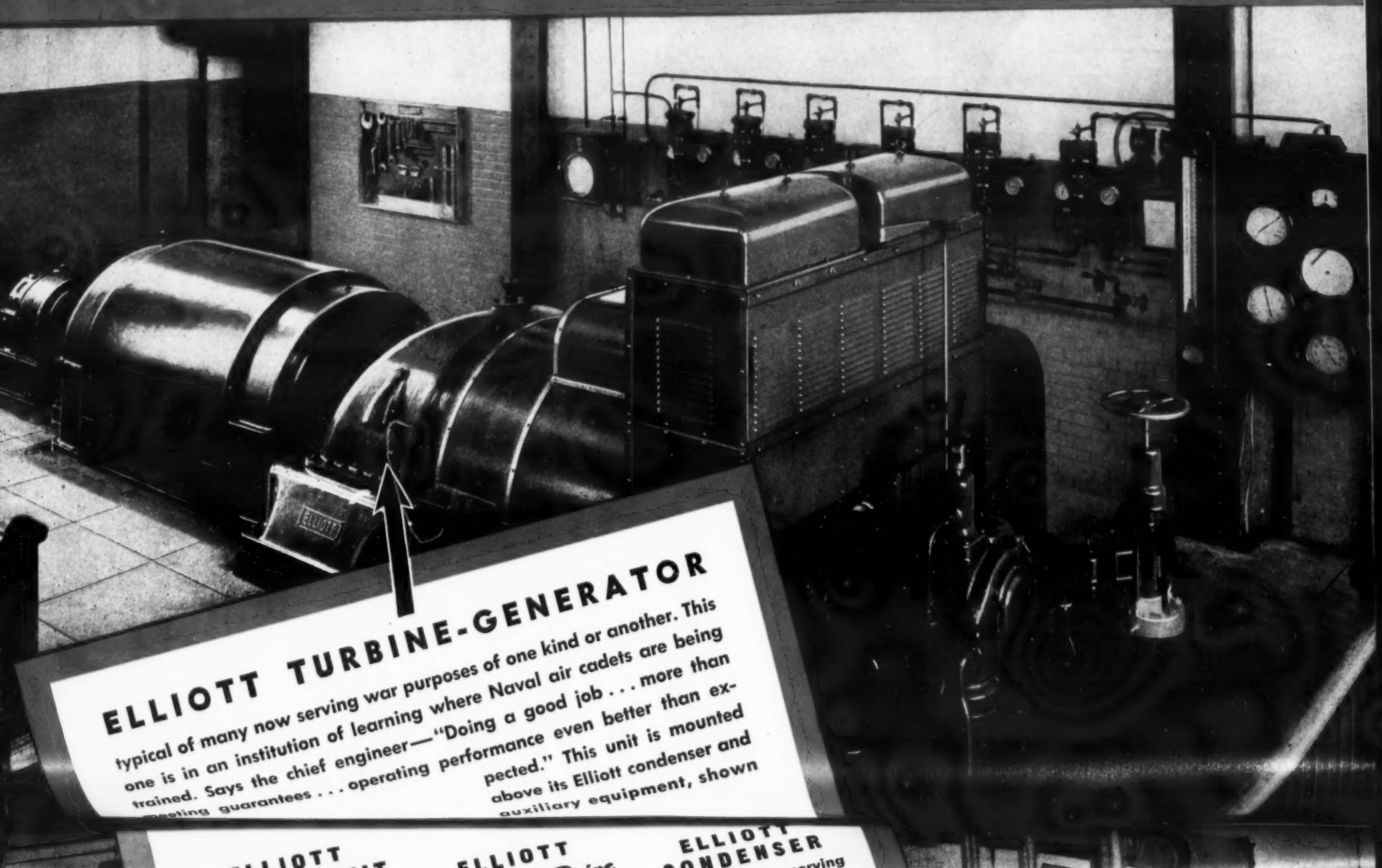
G-234T

Nearly 150 workers are killed each day, on and off the job, through accidents that help the Axis. That is why this Company has subscribed to the National Safety Council's War Production Fund to Conserve Manpower.

Complete details of this unit, including data on sizes available and space requirements, are given in Bulletin G-34 A sent on request.

L FURNACE BOILER

All ELLIOTT – *from top to bottom*



ELLIOTT TURBINE-GENERATOR

typical of many now serving war purposes of one kind or another. This one is in an institution of learning where Naval air cadets are being trained. Says the chief engineer—"Doing a good job . . . more than meeting guarantees . . . operating performance even better than expected." This unit is mounted above its Elliott condenser and auxiliary equipment, shown

ELLIOTT
EJECTOR UNIT
This twin two-stage steam jet ejector maintains the necessary vacuum on the condenser. Like all the related Elliott equipment in this installation, engineering and design are exactly coordinated for best overall operation and accessibility.
ELLIOTT
Mechanical Drive
TURBINE
which drives the condensate pump. Modestly trying to hide behind a pillar, but it's "all there" in reliability plus economical operation.
ELLIOTT
CONDENSER
of surface type, serving the turbine of the generating unit above. Typically Elliott in its sound design, its sturdy structure, and its efficient, dependable performance.
Q-1091
Other Elliott products: Feedwater Heaters and Deaerators, Motors, Centrifugal Blowers, Superchargers for Diesel Engines, Strainers, Desuperheaters Tube Cleaners.
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Data Books
WILL HELP YOU
SOLVE YOUR POWER PROBLEMS

WRITE for these data books now! They are filled with important power plant data generally difficult to locate. When your increased power load demands the installation of new units or the "stretching" of existing plant capacity, you will need this information.

REMOTE READING FLOW METERS — Data Book No. 701

For measuring flow of steam generated by each boiler and the total produced; steam consumed by prime movers and process steam consuming units; water supplied to boilers and pumped to processes; rate of generation, distribution and consumption of natural gas, coke oven gas, compressed air and the like; flow of fuel oil, brine, black liquor and so on; the Republic electrical type flow meter with remote reading instruments, as described in this book, is available.

MECHANICAL FLOW METERS — Bulletins No. 110 and No. 311

When it is desired to measure flow of steam, water, gas, air or oil for the same purposes as outlined above but where remote registration is not required, the Republic mechanical meters described in these books are available.

DRAFT AND PRESSURE INSTRUMENTS — Bulletin No. 802

Proper regulation of draft is one of the most important requirements in obtaining highest combustion efficiency. For indicating and recording drafts, pressures and differentials, Republic indicators and recorders, described in detail in this bulletin, are supplied in any desired combination for all ranges encountered in furnace operation.

REPUBLIC INSTRUMENTS AND CONTROLS

RECORDING THERMOMETERS — Data Book No. 210

Measurements of temperature of flue gas, temperatures in vats or tanks, pipe lines, refrigeration systems, ovens, kilns or ducts and so on, are vital in maintaining highest capacity and efficiency in power plant and process equipment. Republic recording thermometers for this service are described in this data book.

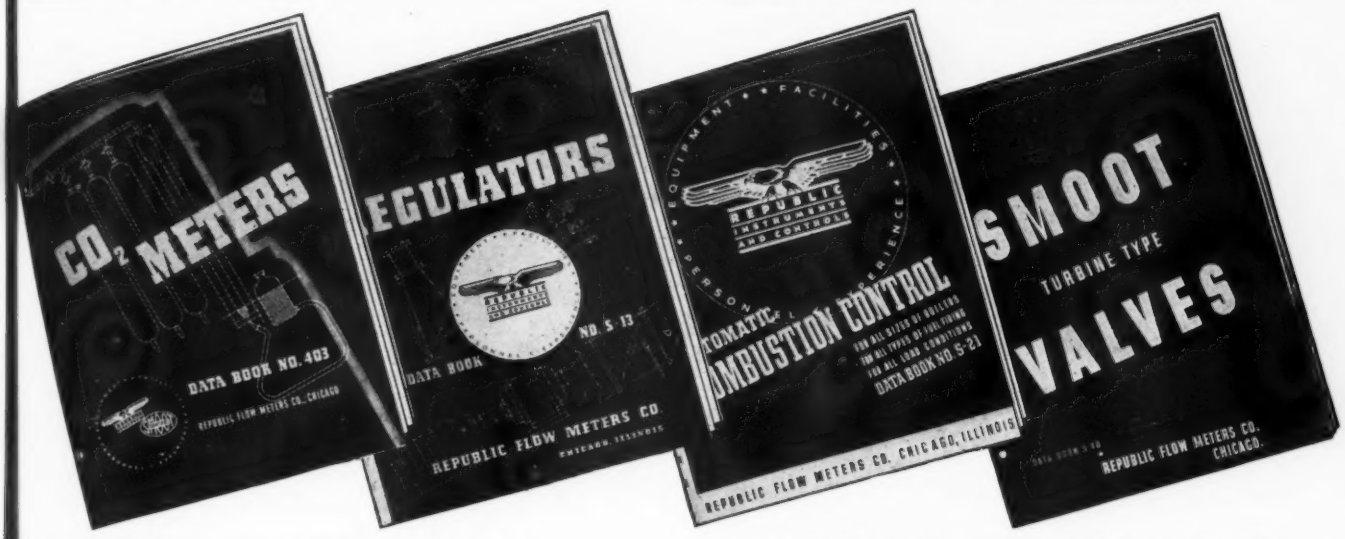
CO_2 METERS — Data Book No. 403

For every fuel and boiler, there is a definite percentage of CO_2 in the flue gas that will assure highest combustion efficiency. The CO_2 meter is the most practical method of determining combustion efficiency. The construction and operation of the Republic CO_2 meter are described in detail in this book.

Republic-Smoot automatic combustion control systems are built for all sizes of boilers, all types of fuel firing and all load conditions, as described in this book, which includes detailed installation reports giving performance data on outstanding power plants.

REGULATING VALVES — Data Book No. S-40

In any plant generating high-pressure, high-temperature steam, there are key valves doing tough jobs in controlling flows or pressures on which vital operations depend — pressure reducing valves co-ordinating high and low pressure steam systems, feedwater valves on 1500 lb. boilers. For such tough jobs, where responsibility, long life and accurate regulation count most and failure must not occur, the Republic-Smoot valves described in this bulletin have been designed.



REGULATORS — Data Book No. S-13

Control of rate of flow of liquids and gases, level of liquids, speed of turbines, engines and motors and proportions between variable pressures and flows must be accurate if maximum plant efficiency is to be attained. These factors are controlled by operation of valves, dampers, rheostats, etc. For sensitive, fast, stable and powerful automatic control of these devices, the Republic-Smoot regulator has been developed. Its construction, operation and applications are described in this book.

AUTOMATIC COMBUSTION CONTROLS — Data Book No. S-21

Boilers must produce maximum steam output at maximum efficiency. That means constant steam pressure, maximum combustion efficiency, constant and correct furnace draft, desired load division among boilers.

DESUPERHEATERS — Data Book No. S-35

In the modern power plant, steam temperatures in interconnected systems — topping turbine bypasses, tie lines, turbine exhaust lines and process steam headers — must be accurately controlled by desuperheaters. For such exacting services, the Republic-Smoot desuperheaters described in this book are employed.

★ ★ ★ ★

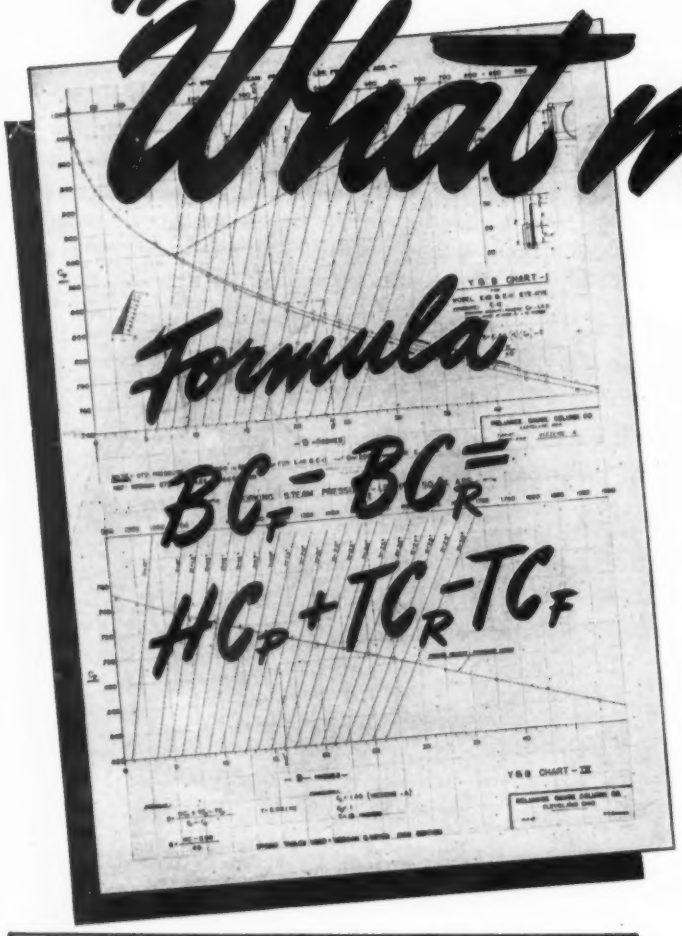
Republic Flow Meters Co. offers a complete manufacturing and engineering service in the field of measurement and control. We will be glad to co-operate with you in the solution of any metering or control problem, whether it involves a single instrument or the automatic control of an entire process or plant. Your inquiries will involve no obligation on your part.

Republic Flow Meters Co.

2222 Diversey Parkway • Chicago, Illinois

Here's the Answer to

"What makes the

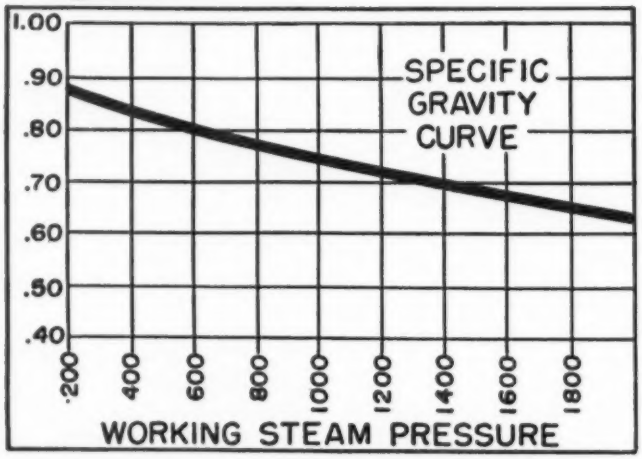


Why you can depend on the accuracy of this popular remote reading boiler water level indicator

YOUR CONFIDENCE in a device destined for continuous service on a vital job must be based on an assurance of its *dependability,* which in turn is insured by *simplicity of design and operation.* That, in one sentence, describes EYE-HYE. Let's prove it.

The basic U tube manometer principle uses hydrostatic pressures for actuation . . . no mechanical parts to wear, adjust or get out of order. Calibration is done at factory . . . nothing to be tampered with on the job.

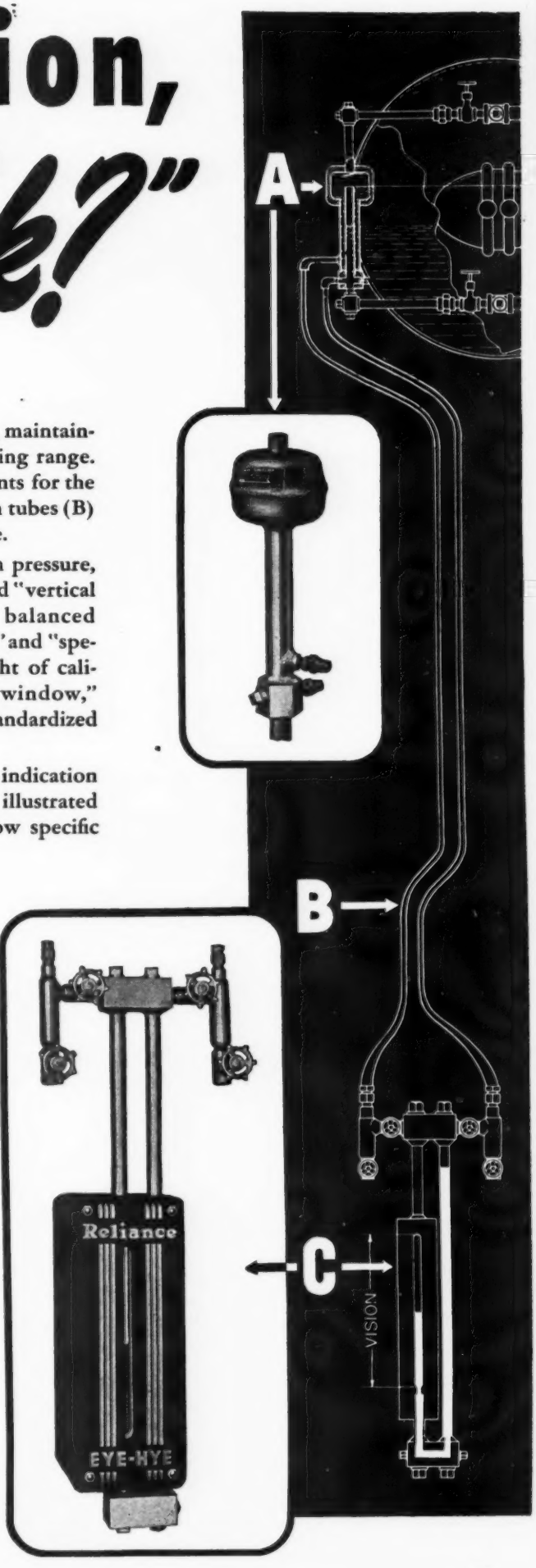
How does it work? A constant hydrostatic head is maintained on the left leg by condensation in the reservoir (A), which contains an overflow tube to return excess condensation to boiler drum. The level in the overflow tube is at all times that of the water in the drum, and overflow tube is connected to the right, or variable head, leg of the EYE-HYE. The actual difference of head pressure on the two legs is counterbalanced by the indicating fluid, "Vizzene," at the bottom of the U (window section of EYE-HYE). Calibration of the window section controls the rise and fall of Vizzene in direct proportion to the rise and fall of water in the drum.



THE RELIANCE GAUGE COLUMN COMPAN

Reliance

Your Question, EYE-HYE *Tick?*"



In the reservoir, one leg of water surrounds the other leg, maintaining the same temperature in both throughout the actuating range. This is highly important to accuracy of reading and accounts for the trade name "Unitemp Reservoir." Below the Unitemp, both tubes (B) and the HYE-HYE (C) are at the same, or room temperature.

Calibration must take into account the working steam pressure, interpreted into "specific gravity of boiler water," and "vertical boiler water level travel to be indicated," which are balanced against the "standard height of visible EYE-HYE window," and "specific gravity of Vizzene" to determine the "bore and height of calibrating tube." Other factors such as "bore of visible window," "safety tube height" and "bore of snubbers" remain standardized for given conditions.

A vital factor utilized to achieve absolute accuracy of indication is the *specific gravity* of the boiler water. Its importance is illustrated in the curve (graph on opposite page) which shows how specific gravity slumps in proportion to increase of steam pressure. This in turn alters the amount of head pressure, the actuating force of the EYE-HYE.

Vizzene indicating fluid is a stable bromine compound exclusively developed for use in the EYE-HYE. Dyed a brilliant green for perfect visibility, it is non-soluble in water, is unaffected by boiler water treatment. Available in several specific gravities for various operating conditions, and is always heavier than water to naturally prevent it from leaving the bottom of the U.

The EYE-HYE and the Unitemp Reservoir are fully covered by patents, and patents pending.

Easy to install, operate and maintain, EYE-HYE brings water level reading where you want it, at eye level.... Write today for Bulletin 382-C containing more complete information — and list of users.

5902 CARNEGIE AVE., CLEVELAND, O.

BOILER SAFETY DEVICES SINCE 1884

Sustained 2.1% Above

This Bailey Boiler Control Panel at the Broadway Pumping Station automatically operates a 50,000-lb. per hour capacity boiler at a sustained efficiency of 82.1%, which is 2.1% in excess of the boiler guarantee.

CITY OF TOLEDO
OHIO

DEPARTMENT OF PUBLIC SERVICE
DIVISION OF WATER
Offices - Erie & Orange Streets

Telephone
MAin 1271

Broadway Pumping Station

Feb.19,1941

ROBERT W. FURMAN
Commissioner

Bailey Meter Co.
1050 Ivanhoe Rd.
Cleveland, Ohio
Attn: Mr.N.M.Barnett

Sub: Automatic Boiler Control

Dear Sir:

This letter is in answer to your recent request concerning the operation of the Bailey Control on our Taylor Underfeed, Stoker Fired, 50,000 lb. per hour B&W Stirling Boiler, installed in 1940.

The control equipment has proven satisfactory beyond all expectations. The unit has been operated at all times under full automatic control. The sustained operating efficiency over a period of 10 months is 82.10%. This compares with a guaranteed efficiency of approximately 80.0%, which indicates operation at very nearly maximum efficiency at all times.

This we believe, was made possible by controlling the fuel bed from the air flow-steam flow of the Bailey Boiler Meter, which maintains a proper fuel bed at all times and thus holds the excess air losses at a constant minimum.

You may feel free to call on us for recommendations at any time.

Very Truly Yours,

Geo. J. VanDorp
Geo. J. VanDorp
Superintendent

GJVD:FB

BAILEY METER CONTROL

BOILER METERS • MULTI-POINTER GAGES • FLUID METERS • RECORDERS • SUPERH

Efficiency Runs Boiler Guarantee

...Station Superintendent Credits Performance to Automatic Readjustment Feature of Bailey Meter Control...

• At the Broadway Pumping Station of the City of Toledo, Ohio, Bailey Meter Control enables operators to continuously obtain efficiencies 2.1% in excess of the boiler guarantee. This installation on a 50,000-lb. per hour capacity, B & W Stirling Boiler, was made last year by the J. A. Young Co. of Toledo.

According to Mr. VanDorp's letter of February 19, 1941, sustained operating efficiency is made possible by controlling the fuel bed from the air flow—steam flow of the Bailey Boiler Meter which maintains a proper fuel bed at all times and thus holds the excess air losses at a constant minimum.

Automatic readjustment from the Bailey Boiler Meter is only one of the worthwhile extra values which Bailey Meter Control offers. Other features not found in ordinary control systems are:—

1. Control impulses are originated by standard Bailey Meters of proven accuracy.
2. Provision is made for addition of interlocks and other safety devices, in the control system.
3. Experience gained from the successful operation of thousands of boilers is built into each Bailey Control system.
4. Reliable Service for Bailey Meter Control is readily available through a staff of full-time Bailey engineers conveniently stationed in some 30 cities throughout the United States and Canada.

Bailey Meter Control is the power engineer's boiler room deputy —always on duty to save fuel, protect equipment and render reliable power service.

Ask for bulletin No. 102-C, which tells the full story of this complete combustion control system.

BAILEY METER COMPANY

1036 IVANHOE ROAD • CLEVELAND, OHIO

Bailey Meter Company Limited, Montreal, Canada

A-72

BAILEY METERS

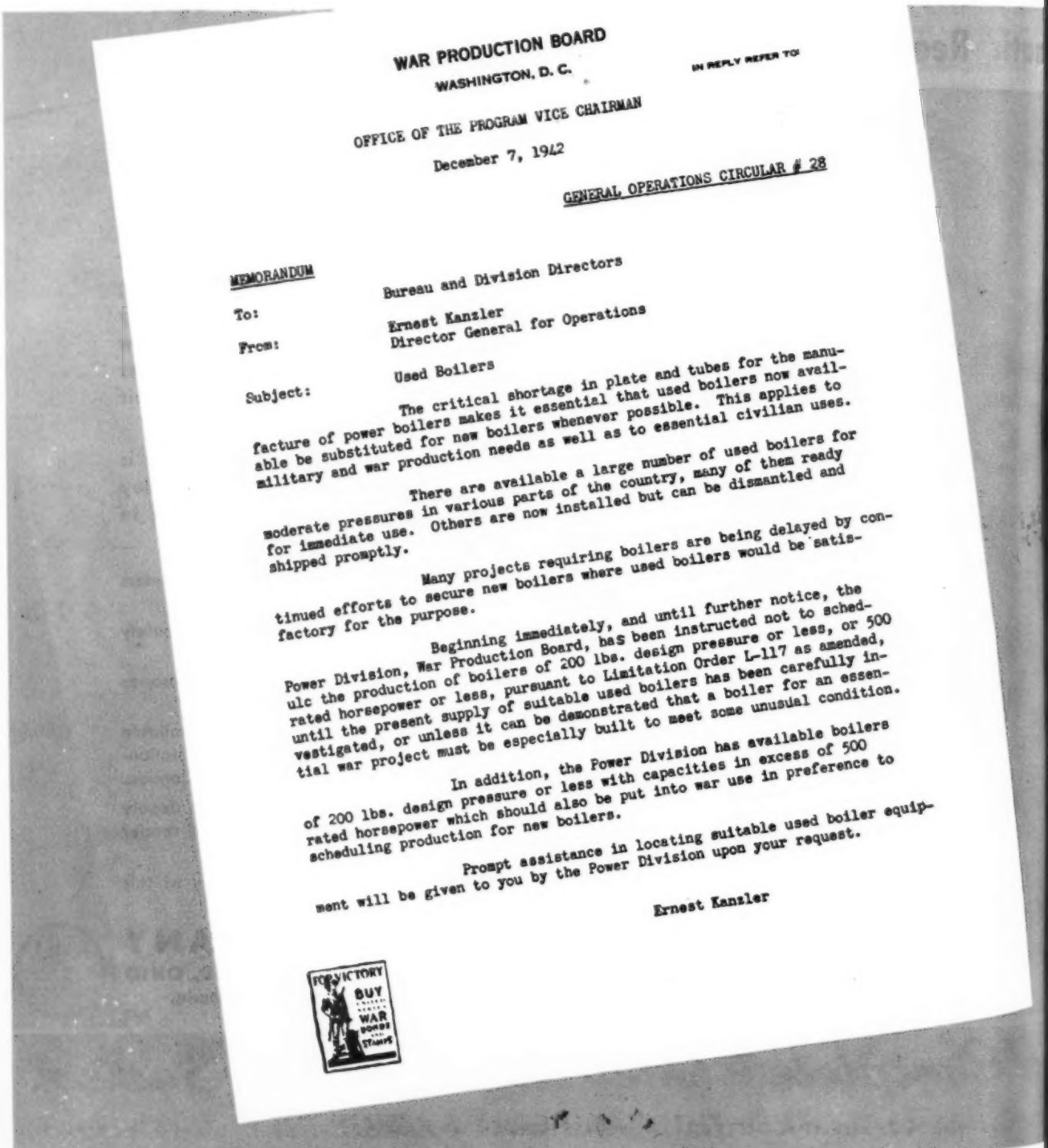
The Complete Combustion Control System

DESUPERHEAT CONTROL • COMBUSTION CONTROL • FEED WATER CONTROL

EVERY PARAGRAPH OF THIS

. . . is of immediate importance to

BOILER USERS



WAR PRODUCTION BOARD
WASHINGTON, D. C.

IN REPLY REFER TO:

OFFICE OF THE PROGRAM VICE CHAIRMAN

December 7, 1942

GENERAL OPERATIONS CIRCULAR # 28

MEMORANDUM

To: Bureau and Division Directors

From: Ernest Kanzler
Director General for Operations

Subject: Used Boilers

The critical shortage in plate and tubes for the manufacture of power boilers makes it essential that used boilers now available be substituted for new boilers whenever possible. This applies to military and war production needs as well as to essential civilian uses.

There are available a large number of used boilers for moderate pressures in various parts of the country, many of them ready for immediate use. Others are now installed but can be dismantled and shipped promptly.

Many projects requiring boilers are being delayed by continued efforts to secure new boilers where used boilers would be satisfactory for the purpose.

Beginning immediately, and until further notice, the Power Division, War Production Board, has been instructed not to schedule the production of boilers of 200 lbs. design pressure or less, or 500 rated horsepower or less, pursuant to Limitation Order L-117 as amended, until the present supply of suitable used boilers has been carefully investigated, or unless it can be demonstrated that a boiler for an essential war project must be especially built to meet some unusual condition.

In addition, the Power Division has available boilers of 200 lbs. design pressure or less with capacities in excess of 500 rated horsepower which should also be put into war use in preference to scheduling production for new boilers.

Prompt assistance in locating suitable used boiler equipment will be given to you by the Power Division upon your request.

Ernest Kanzler

FOR VICTORY BUY WAR BONDS AND STAMPS

WPB MEMORANDUM . . .

WHAT TO DO ABOUT IT

1 If you need additional boiler capacity

You can save a lot of time and trouble by getting in touch with Power Division, War Production Board, Washington, D. C. This division controls not only the boiler plate schedules of the mills but also the shop schedules of all boiler manufacturers.

If you want a boiler of not over 500 rated hp and not over 200 lb design pressure, in all probability you will be referred to the Used Equipment & Machinery Branch, Redistribution Division, where information on several thousand second-hand boilers is available for your inspection. You may select a boiler to meet your conditions and negotiate with the owner. Upon completion of negotiations, you must obtain release and authority to purchase from the Power Division of WPB, on Form PD-677.

If your requirements are beyond the limits of available used boilers, **WPB will advise you whether your needs entitle you to purchase a new boiler.** If your application to do so is approved, you may proceed in the usual manner to get quotations and make your purchase from whatever boiler manufacturer you choose.

2 If you have spare boiler capacity

Your Government is interested in getting information on any boilers that can be spared in sizes ranging from 35 hp up with operating pressures from 15 lb up. Somewhere there is a plant that can put to much-needed use just such a boiler as you may be able to release.

If you have one or more boilers you can spare, notify the War Production Board, Used Equipment & Machinery Branch, Redistribution Division, Washington, D. C. Give type of boiler, its present location, steam pressure, rated horsepower, name and address of owner and briefly describe its general condition, age, etc. Your boiler will then be listed in the Government records of available used equipment and anyone interested in its purchase can get in touch with you.

It is a patriotic duty of the first order to help place needed equipment where it will serve a vital war purpose. Therefore, don't delay to notify the Government if you have one or more boilers you can get along without.

3 If you want "in-the-field" assistance with your problem

Perhaps there is some aspect of your problem you would like to discuss. C-E representatives throughout the country are generally familiar with the regulations and procedures. They will be glad to assist you in any way they can. Addresses and 'phone numbers are as follows:

Birmingham, Ala., Martin Bldg. ..... *Birmingham 4-1708*
Boston, Mass., Chamber of Commerce Bldg. ..... *Hancock 6650*
Charlotte, N. C., Independence Bldg. ..... *Charlotte 2-1228*
Chattanooga, Tenn., 1032 West Main St. ..... *Chattanooga 7-1221*
Chicago, Ill., Bankers Bldg. ..... *Randolph 2417*
Cincinnati, Ohio, Gwynne Bldg. ..... *Cherry 6735*
Cleveland, Ohio, Guardian Bldg. ..... *Main 5364*
Denver, Colorado, 1940 Blake St. ..... *Main 4818*
Detroit, Mich., Book Bldg. ..... *Randolph 7546*
Hazleton, Pa., Markle Bank Bldg. ..... *Hazleton 1090*
Houston, Texas, Mellie Esperson Bldg. ..... *Fairfax 8206*
Kansas City, Mo., Board of Trade Bldg. ..... *Harrison 3011*
Los Angeles, Calif., Architects Bldg. ..... *Michigan 8571*
Minneapolis, Minn., Plymouth Bldg. ..... *Geneva 1820*
New York, N. Y., 200 Madison Ave. ..... *Lexington 2-1500*
Philadelphia, Pa., 1616 Walnut St. ..... *Pennypacker 7020*
Pittsburgh, Pa., First National Bank Bldg. ..... *Atlantic 1510*
Portland, Ore., 3019 N. E. 26th Ave. ..... *Atwater 6444*
St. Louis, Mo., 5319 Shreve Ave. ..... *Goodfellow 5600*
Salt Lake City, Utah, 210 So. West Temple St. ..... *Salt Lake City 5-1242*
San Francisco, Calif., Monadnock Bldg. ..... *Garfield 8315*
Seattle, Wash., 1411 Fourth Ave. ..... *Elliott 6662*
Spokane, Wash., 3219 Wellington Place ..... *Broadway 0572*
Tacoma, Wash., Tacoma Bldg. ..... *Main 4281*

NOTE: **If you purchase a used boiler, we can help you with modern firing equipment that will enable you to get the most out of it. Call on our nearest district office.**

A-708

COMBUSTION ENGINEERING

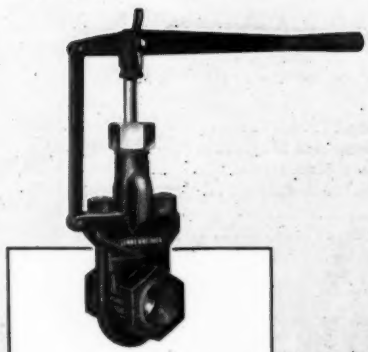
COMPANY, INC. • 200 MADISON AVENUE, NEW YORK, N. Y.

Inside Screw
Fig. 1640, I. B. B. M.
Fig. 1644, All-Iron

Inside Screw
Fig. 1641, I. B. B. M.
Fig. 1645, All-Iron

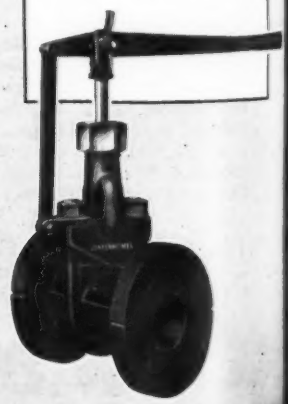
Outside Screw
Fig. 1681, I. B. B. M.
Fig. 1683, All-Iron

Outside Screw
Fig. 1682, I. B. B. M.
Fig. 1684, All-Iron



Quick Operating
Fig. 1642, I. B. B. M.
Fig. 1646, All-Iron

Quick Operating
Fig. 1643, I. B. B. M.
Fig. 1647, All-Iron



Every Minute Saved in Maintenance . . . Means More Productive Hours

And these husky "King-clip" valves are doing just that . . . saving those precious minutes that add up to more productive time. With "King-clips" on the job, maintenance is cut to a minimum . . . users are assured of a practically permanent installation, free from the hundred-and-one "valve headaches".

"King-clip" Valves are doing their part in another respect, too . . . in conserving critical materials. Since only the working parts are made of bronze, these iron body valves use less copper, tin and other scarce materials than all-bronze valves, at the same time performing equally as well on many services.

And here's an important point . . . you are likely to get better deliveries on "King-clips" than on the scarcer all-bronze valves. The complete facilities of Lunkenheimer distributors are at your service. They'll go all out to help you get the things you need.

Since virtually all materials used in the manufacture of valves are on the list of critical materials, valve users are urged to furnish the highest possible preference ratings and proper "end use" information on their orders. This will be of mutual helpfulness.

Catalog 78 available on request

ESTABLISHED 1862

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THE LUNKENHEIMER CO.

"QUALITY"

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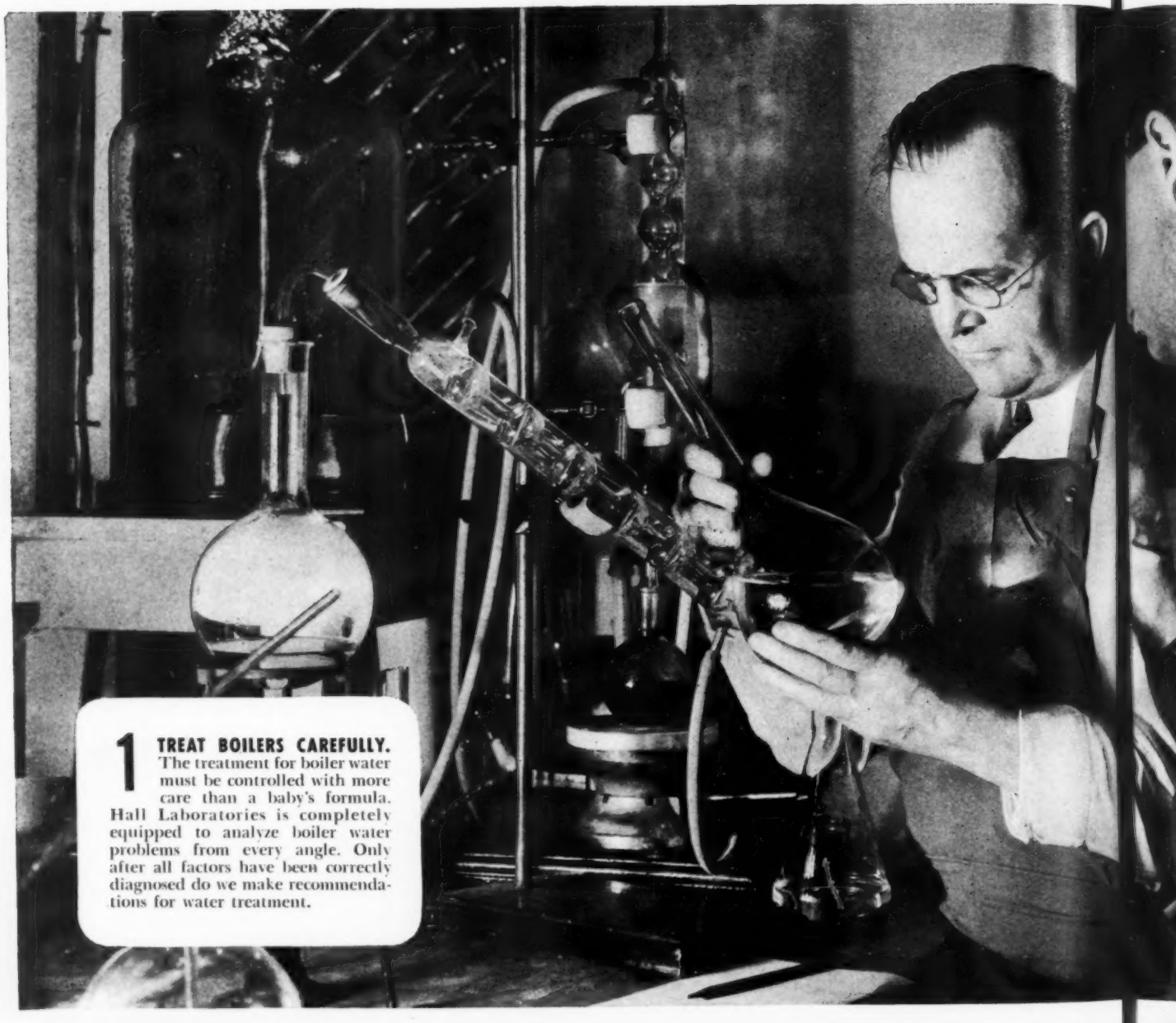
EXPORT DEPT., 318-322 HUDSON ST., NEW YORK

BRONZE, IRON AND STEEL VALVES, 125 TO 2500 LB. S.P. FOR ALL INDUSTRIES; BOILER MOUNTINGS, LUBRICATING DEVICES, AIRCRAFT FITTINGS

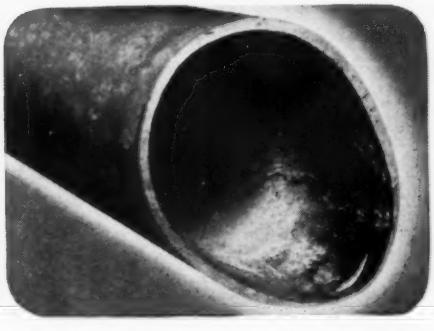
No. 5-85-43

It's a good time to

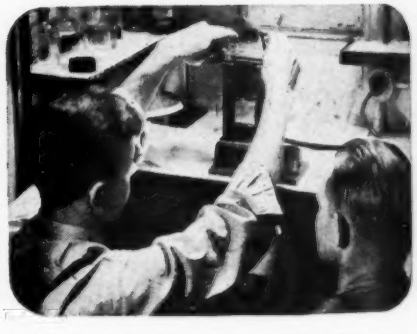


1 TREAT BOILERS CAREFULLY. The treatment for boiler water must be controlled with more care than a baby's formula. Hall Laboratories is completely equipped to analyze boiler water problems from every angle. Only after all factors have been correctly diagnosed do we make recommendations for water treatment.

2 KEEP 'EM CLEAN. Clean boiler tubes are your best assurance of top steam production. Hall Service Engineers inspect your boilers at frequent intervals to make sure that satisfactory water conditions are being maintained.



3 PROTECT OVERWORKED BOILERS. Many boilers are overworked today and may avenge themselves by going off the line for repairs. Hall Service provides for greatest latitude of operation without damaging results.



4 WATCH FOR SIGNS OF TROUBLE. Vigilance should be the power engineer's middle name. If even a paper-thin scale develops in high pressure boilers, it is time to call in a Hall Service Engineer. Prompt action can often avert trouble.

be "nice" to your boilers

You may have felt you could "treat 'em rough" in the "good old days" ...but not any more

BOILERS and boiler parts are in the semi-precious class today. You've got to nurse, and even pamper, them. And that goes for the duration. They must be made to last.

That's what gives Hall preventive care its great importance. For the application of preventive remedies for the ills of scale, corrosion, carryover and embrittlement is the only real security against boiler failure.

Hall Laboratories fathered the modern system of preventive care, introduced the first scientific treatment of boiler ills arising from water conditions, based their work on the system of administering constant field aid through salaried engineers whose sole interest is devoted to the practice of keeping boilers on the line. Hall Laboratories train these men, give them the support of the world's finest facilities for the diagnosis of boiler troubles, send them out fully equipped with the knowledge and experience needed for their highly technical job.

No other type of service can so effectively and completely meet this industrial need.

A lot of power plant engineers must think so, too, because the finest plants in America practice Hall preventive care. If the most competently equipped and ably manned of these need this service, you need it.

It's not too late. There will never be a better time to find out what preventive care can do for you. Write for particulars.

HALL LABORATORIES, INC. · HAGAN BUILDING, PITTSBURGH, PA.

A subsidiary of Hagan Corporation

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HALL SERVICE IN A NUTSHELL

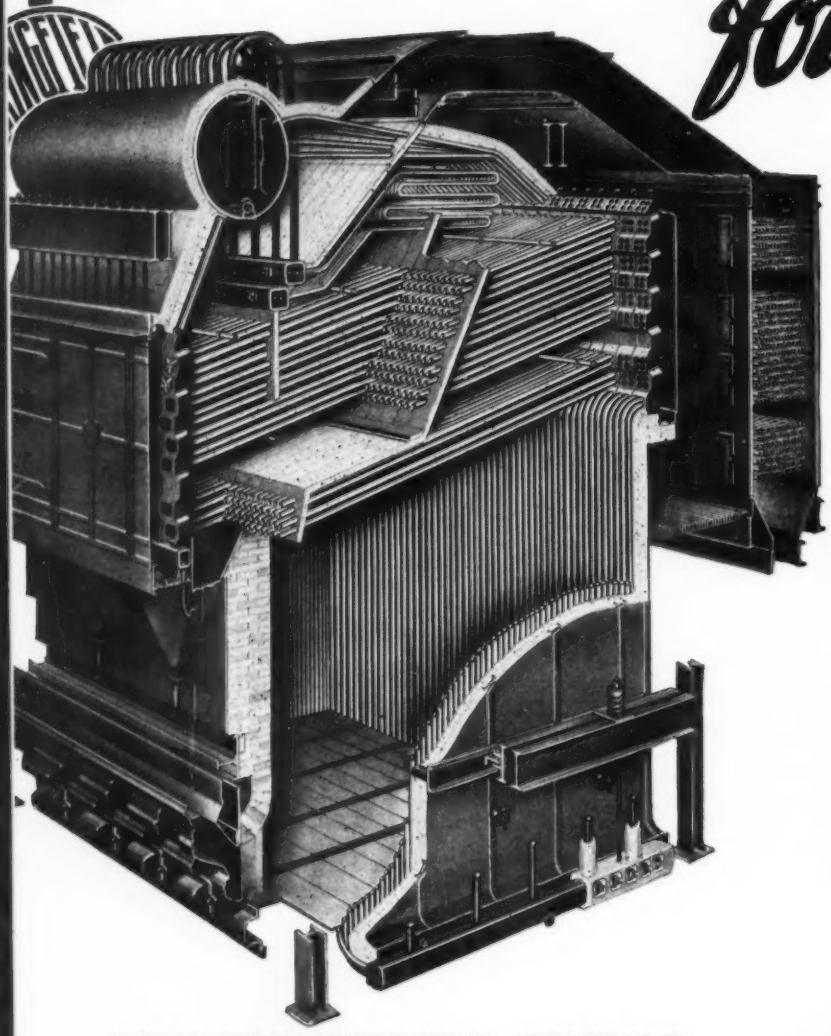
At your immediate disposal are placed the technical knowledge and facilities of the pioneering leaders in scientific boiler water conditioning. In addition, with your full cooperation, Hall Service:

1. Minimizes boiler outages caused by water.
2. Helps maintain highest efficiency.
3. Establishes non-embrittling water.
4. Minimizes carryover.
5. Prevents corrosion in boilers and associated equipment.
6. Prevents deposition in water lines and cooling systems.

5 APPLY PREVENTIVE REMEDY. Your operating men working with Hall Service Engineers and Research Chemists form a combination that can keep boilers operating at peak capacity. Preventive care today is absolutely necessary.

HALL SYSTEM
of Boiler Water Conditioning

NOW is the time TO THINK ABOUT BOILERS for Next Winter



THE "straw that breaks the camel's back" many a plant may be winter heating deman on already overloaded boilers. If this is your sit tion, or if you need new boiler capacity for a other reasons, you'll be in a better position to so the problem if you'll lay your plans just as early possible.

Springfield is in excellent position to help y plan your requirements and get your boilers to y with a minimum of delay. Springfield boiler desi permits faster fabrication and faster erection. T Springfield shop is capable of handling the m special requirements or complete drawings, p terns, etc., are on hand to produce duplicate un of many of the modern Springfield generati units built in recent years. Write today for f ther facts on the quickest way to get the boi capacity you need. SPRINGFIELD BOIL COMPANY, 1953 E. Capitol Ave., Springfield,

CHECK THESE TIME-SAVING ADVANTAGES OF SPRINGFIELD BOILER DESIGN

SINGLE DRUM—requires less hard-to-get steel plate than multiple drum designs.

SECTIONAL CONSTRUCTION—tubes, headers and baffles shop-assembled and shipped as complete headers sections to save 30 to 60 days field construction time.

STRAIGHT TUBES—less shop time for bending.

FEWER TUBE SIZES—less delay getting materials.

MINIMUM DELAY IN EVENT OF DRUM STEEL SHORTAGE—Even if steel plate for drum is delayed, the rest of the job can go in and 90% of installation completed before drum arrives.

ATTENTION SPRINGFIELD BOILER USERS: NEED MORE STEAM?
IF YOU NEED MORE STEAM, WATER WALLS ADDED TO YOUR PRESENT BOILERS TOGETHER WITH OTHER NECESSARY CHANGES MAY SOLVE YOUR PROBLEM. WRIT US FOR DETAILS

SPRINGFIELD

STEAM GENERATING UNITS

SPRINGFIELD BOILERS

ANY SIZE ANY FUEL ANY PRESSURE

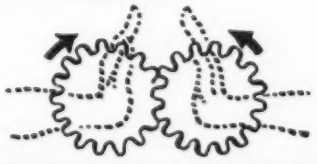
Neglect a Motor AND YOU Sabotage a Motor!

WHOSE MOTORS LAST LONGEST MAY HAVE A LOT TO DO WITH WHO WINS THIS WAR!

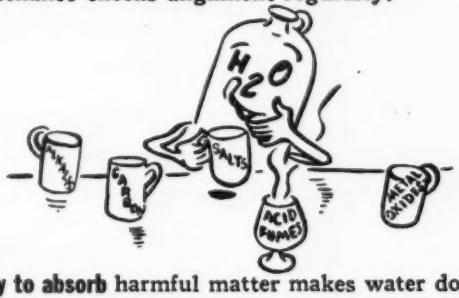
AS ONE of the world's leading builders of electric motors, Allis-Chalmers takes its hat off to the men of maintenance who are working day and night to keep America's motors *rolling!*

Like an overloaded horse, a motor worked too far beyond its horsepower capacity is sure to break down. So while maintenance men know that we've got to get maximum protection out of every motor to win this production war ... they also know that a close eye must be kept on every motor's overload protection. New fuses and heater coils are a whole lot cheaper than new motors!

The oil film protecting a motor's bearings often is no thicker than the wall of a soap bubble. And if pressure on it becomes too great, the film can fail just as suddenly and *completely!* To protect bearings, maintenance must first protect the *oil film* ... by guarding against excessive pressures from misalignment.

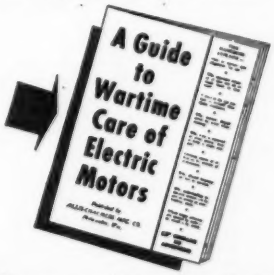


Spur gears constantly try to push apart, foundations are apt to settle, floor loading can be too heavy ... all threatening to disturb alignment. Misalignment sometimes gives a warning before causing damage. But to play safe, maintenance checks alignment *regularly.*



Ability to absorb harmful matter makes water doubly dangerous. Evaporated moisture is pure water when it first condenses in a motor — isn't yet an active destructive agent. That's the time to get it out — *fast!*

Dust fights lubrication. Once inside bearings, it can be as harmful as sandpaper to highly polished surfaces. To keep dust out, oil filler caps must be kept closed — dust seals and gaskets replaced when worn.



Is Allis-Chalmers' new maintenance handbook helping maintenance do its big new wartime job in *your* plant? It's the latest and last word on the subject, easily understood, abundantly illustrated (with dozens of sketches such as above). Send in today for *your* free copy to ALLIS-CHALMERS MFG. CO., MILWAUKEE, WIS.

A 1554

ALLIS-CHALMERS

Help to save power for Victory. See that your power transmission units are equipped with Timken Bearings. Meet post-war conditions advantageously.

Timken Bearing Equipped pillow blocks and line shaft hangers keep power moving from source to job without loss. Friction doesn't have a chance; shaft wear is prevented; radial-thrust loads are kept under control constantly; lubrication is simple and sure. Furthermore, there is no leakage of lubricant—consequently no danger to product.

Manufacturers whose power transmission systems consist of obsolete equipment are paying for power they don't use — power burned up by friction.

Check up on your transmission units now and replace every friction-ridden power waster with modern Timken Bearing Equipped power savers. The Timken Roller Bearing Company, Canton, Ohio.

"All There Is In Bearings"

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

The one test for every decision — *Will it help to win the war?*

Medart Type SS Pillow Block equipped with Timken Tapered Roller Bearings.

What YOU Can Do About Scrap

EXECUTIVE:

Appoint a scrap director, armed with authority to act. Promote the use of posters, pay-envelope stuffers, and collection goals to enlist employees in the scrap campaign.

Make each foreman responsible for preventing waste in his department.

Enforce monthly rechecks in every department to find scrap material previously overlooked.

Report regularly on your plant's collection of scrap to the Industrial Salvage Committee set up by WPB in your community.

•

SUPERINTENDENT, FOREMAN, OR TECHNICIAN:

Survey all plant equipment, particularly idle, broken, or obsolete machines, and determine what might be salvaged, and what should be scrapped. Remember, any machine is more valuable repaired than scrapped.

Classify all scrap metal by its alloy content.

Provide separate containers, clearly marked for each class of scrap material.

Speed the return of scrap to steel mills through existing channels.

•

WORKMAN:

Comb plant and yards for dormant scrap and unusable and abandoned equipment.

Report promptly the equipment which is out of use. If equipment has not been used for some time, and you see no use for it in the near future, transfer it to where it can be used, or scrap it.

Salvage usable parts from equipment marked for scrapping.

SCRAPPY SAYS:

Yes sir, we've got to have scrap. It takes scrap to make steel. And it takes lots of steel to win a war. DO YOUR PART!

ELECTRO METALLURGICAL COMPANY

Unit of Union Carbide and Carbon Corporation

30 East 42nd Street UCC New York, N. Y.

Electromet

Trade Mark

Ferro-Alloys & Metals

Automatic AIR ELIMINATION is

ADVERSE EFFECT OF AIR ON STEAM TEMPERATURE

Fig. 1 represents a pressure chamber filled with air at 14.7 lb. absolute pressure. Each diamond represents a molecule of air.

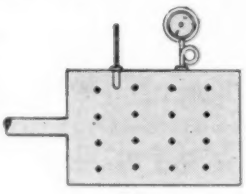


Figure 1

In Fig. 2 the same pressure vessel is filled with steam molecules, represented by crosses, at 14.7 lb. absolute pressure. Since the pressure is the same there are the same number of molecules as in Fig. 1. Steam temperature is 212 deg. F.

Fig. 3 represents the pressure chamber filled with the same amount of air as in Fig. 1 plus the same amount of steam as in Fig. 2. Since there are twice as many molecules in the same space, the pressure is doubled or 29.4 lb. absolute. However, in spite of the increased pressure, there are no more steam molecules than in Fig. 2 and the pressure due to steam is still 14.7 lb. absolute so the temperature is 212 deg. F.—*no increase in temperature despite increase in pressure.*

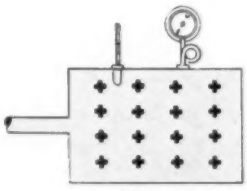


Figure 2

The same problem from another approach: Assume every steam molecule in Fig. 3 except one is replaced by an air molecule. The pressure will remain at 29.4 lb. absolute but with a single steam molecule in a pressure chamber of any size, the temperature would be approximately room temperature rather than 212 deg. F. — *air lowers temperature.*

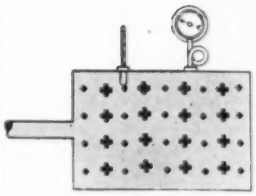


Figure 3

ADVERSE EFFECT OF AIR ON HEAT TRANSFER

Rate of heat transfer will be reduced far more than the reduction in steam temperature might indicate unless the velocity of entering steam is sufficient to keep the air and steam mixed perfectly. A mixture of steam and air will flow to the surface to replace steam that is condensed but the steam will be to some extent prevented from reaching the surface by air that remains after the steam is condensed. This is shown in Fig. 4.

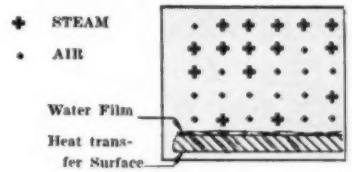


Figure 4

In time the concentration of air on the heating surface may be many times as great as the concentration of air mixed with steam at some distance from the surface. It has been stated by one authority that under extreme conditions, one-half of 1% by volume of air mixed with steam may result in a reduction of heat transfer efficiency as great as 50%.

Table showing temperature reduction caused by air at various pressures.

Gauge Pressure	Temperature of Steam with No Air Present	Temperature of Steam Mixed with Various Amounts of Air. (Per Cent Air by Volume)		
		10%	20%	30%
10.3	240.1	234.3	228.0	220.9
25.3	267.3	261.0	254.1	246.4
50.3	298.0	291.0	283.5	275.1
75.3	320.3	312.9	304.8	295.9
100.3	338.1	330.3	321.8	312.4

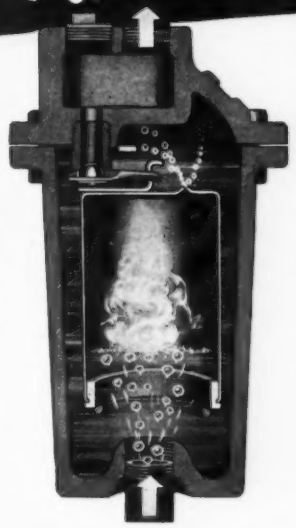
ARMSTRONG TRADE MARK "INVERTED BUCKET" STEAM TRAP

Armstrong

N is an essential of GOOD TRAPPING

HOW ARMSTRONG TRAPS ELIMINATE AIR

The illustration at the right shows how air, always present in steam, is eliminated through the vent in the Armstrong Inverted Bucket. Any air entering the trap ahead of condensate or coming in with the steam, passes through this vent. It collects at the top of the trap and is discharged ahead of the condensate when the valve opens. (Any steam escaping through the bucket vent is condensed by the surrounding water to help make up for the radiation loss from the trap.)



AND FOR EXTRA FAST AIR REMOVAL — ARMSTRONG BLAST TRAPS

Where large amounts of air must be handled quickly when the steam is first turned as is often desirable with low pressure heating or "up-and-down" process units, the Armstrong Blast Trap illustrated at the left will work wonders in speeding up heating.

An Armstrong Blast Trap differs from a standard trap only in that the inverted bucket is equipped with an auxiliary air vent which is controlled by a flat disc mounted at the end of a strip of rustless thermostatic bi-metal. When steam is first turned on, the auxiliary vent in the top of the bucket is wide open which prevents the bucket from floating and closing the discharge valve. Air and water blow straight through (see picture at left) until steam comes in and causes the bi-metal strip to bend upward, closing the auxiliary vent. Thereafter, the trap works the same as a standard trap.

USERS of Armstrong Steam Traps know that they will meet all the conditions imposed upon them by almost any operating conditions. Armstrong Traps eliminate air and discharge condensate as fast as it forms under light, heavy or intermittent loads with no steam leakage. They handle all ordinary dirt and scale. The valve is immune to wire-drawing. There are no parts to stick, bind or wear rapidly. They are simple, long-lived and easy to inspect and maintain. Choice of body styles makes installation simple.

These features will help you save time, fuel and manpower, help you increase plant output. Find out more about Armstrong Traps today.

• How to select the right trap for the job is easy with The ARMSTRONG STEAM TRAP BOOK. And how to get the most out of your traps is well explained in the new SERVICE GUIDE. Ask for copies.

ARMSTRONG MACHINE WORKS

812 Maple Street • Three Rivers, Michigan

STEAM TRAPS

FACTS *you should know about* HARD-FACING MATERIALS

By means of hard-facing—which is the process of welding on to wearing parts a coating, edge, or point of a hard metal—it is possible to protect metal surfaces that normally wear away rapidly in service. This method not only makes industrial parts last from two to twenty-five times longer, but also reduces time lost for replacements, lowers power consumption, and helps to maintain high efficiency. In addition, hard-facing often makes possible the use of substitute base metals in the fabrication of parts. Outlined below are facts you should know when selecting hard-facing rods.

Properties Required for Hard-Facing

High-quality materials are required to obtain full benefit from hard-facing. The materials should possess the following properties:

1. Inherent hardness.
2. Resistance to abrasion.
3. "Red Hardness"—or the retention of initial hardness up to red heat.
4. Ease of application by ordinary welding techniques.
5. Resistance to high-temperature oxidation during application by welding.
6. A melting point slightly lower than that of steel, the usual base metal.
7. A coefficient of expansion close to that of the base metal.

Types of Materials Available

Group 1—These alloys are relatively low in cost. They are alloy steels consisting of an iron base with less than approximately 20 per cent of alloying constituents. *Example: Hascrome iron-base hard-facing rod.*

Group 2—These are iron-base alloys containing more than 20 per cent of alloying elements. They are useful for services involving more severe abrasive wear than the metals of group 1. *Example: Haynes Stellite "93" hard-facing rod.*

Group 3—This group is made up essentially of non-ferrous cobalt-chromium-tungsten alloys. Hardness is inherent and retained at high temperatures. *Example: Haynes Stellite grades 1, 6, and 12 non-ferrous hard-facing rod.*

Group 4—The fourth group consists of tungsten carbide "diamond substitute" materials, supplied in a variety of forms, and combining a maximum of wear resistance with cutting qualities when applied on the cutting edges of earth drilling tools. *Example: Haystellite composite rod, tube rod, and inserts.*

Send for Helpful Literature

Write for the booklet "*Hard-Facing Materials Data.*" It can be tacked on the shop wall for convenient reference on such points as the selection of the right rod, application techniques, and amount of rod required. A copy will be sent without charge.

HAYNES STELLITE TRADE MARK

HAYNES STELLITE COMPANY

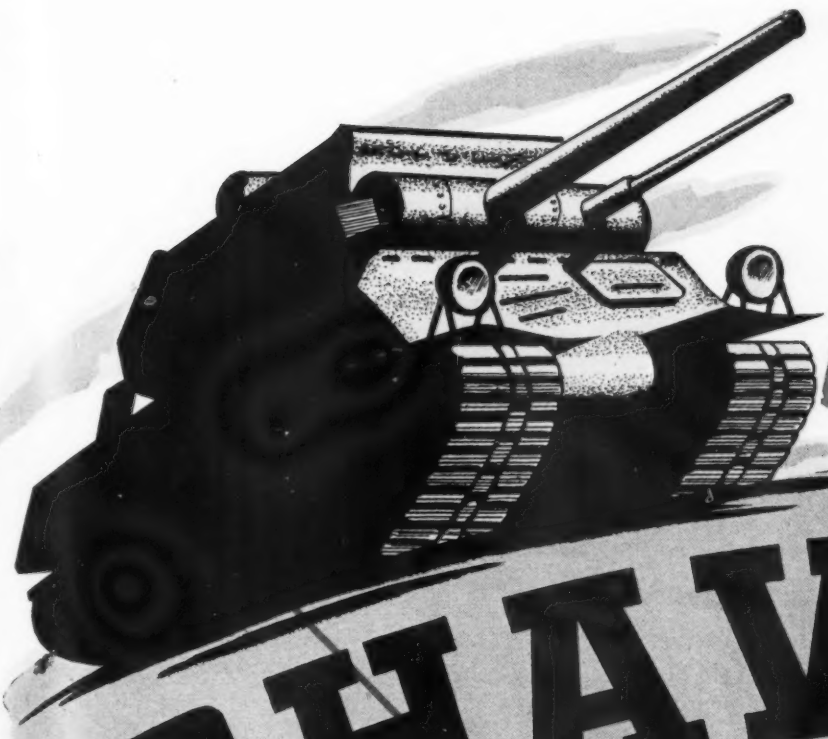
Unit of Union Carbide and Carbon Corporation

New York, N. Y. UCC Kokomo, Ind.

Chicago—Cleveland—Detroit—Houston—Los Angeles—San Francisco—Tulsa

HARD-FACING RODS FOR EVERY PURPOSE

The words "Haynes Stellite," "Hascrome," and "Haystellite," are registered trade-marks of Haynes Stellite Company.



Playing a Vital Role in the *War* Effort!

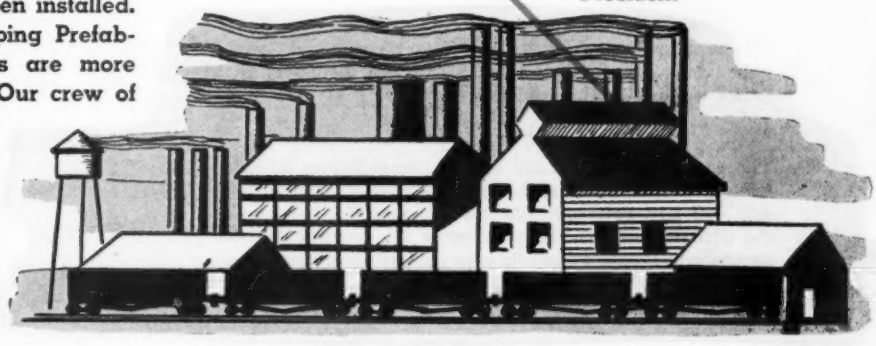
SHAW

PREFABRICATED PIPING

To produce enough of the all-important Explosives, Synthetic Rubber, 100 Octane Gasoline, required by the war — new plants must be built — old ones expanded — and fast. In this plant expansion program, all types of piping are needed — piping for processing, piping for power generating stations, piping that has to be bent, flanged, welded and heat-treated . . . then installed. Shaw is helping to do this Piping Prefabrication job. Today — minutes are more vital to us than ever before. Our crew of workers, numbering over 5,000, both in our home plants and in our field forces, are working 24 hours a day, seven days a week to provide and install the piping needed to meet war's unceasing demands.

Our ability to adjust our production to meet these wartime demands has been the result of our 50 years of specialized experience in prefabricated piping. Our engineering staff is available to you on any piping problem. We invite your inquiry.

Benj. F. Shaw III
President



50th Anniversary Year

BENJAMIN F. SHAW COMPANY

2nd & Lombard Streets, Wilmington, Delaware
PIPING FABRICATORS AND CONTRACTORS

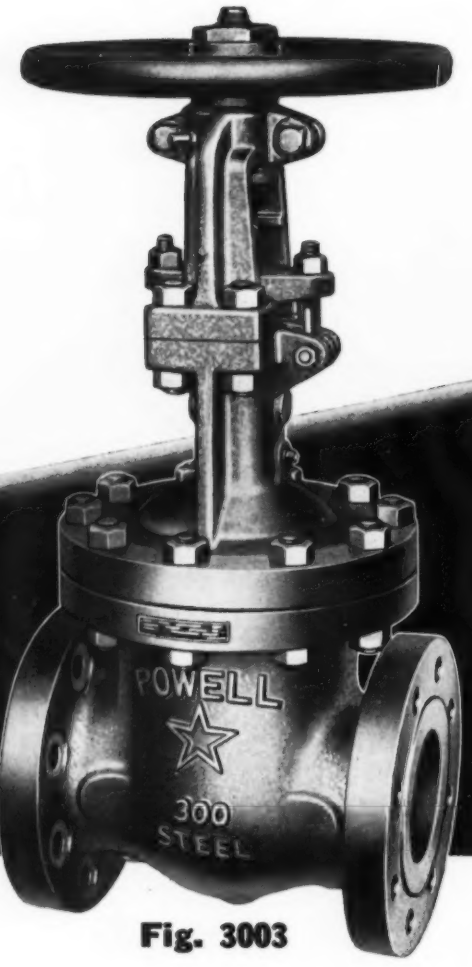


Fig. 3003

Fig. 3003—Class 300 pound Cast Steel Gate Valve. Has outside screw rising stem and two-piece bolted flanged yoke. Available in sizes from 1¼" to 24" inclusive, with either flanged or welding ends.

Fig. 9003 WE—Class 900 pound Cast Steel Gate Valve. Has outside screw rising stem and two-piece bolted flanged yoke. Available in sizes from 3" to 24" inclusive, with either welding or flanged ends.

The complete Powell Line of Cast Steel Valves includes Globes, Angles, Checks, Gates, Non-returns, etc., for 150, 300, 400, 600, 900, 1500 and 2500 pounds W. P.—to meet the demands of American Industry for dependable flow control equipment to handle ever increasing pressures and temperatures.

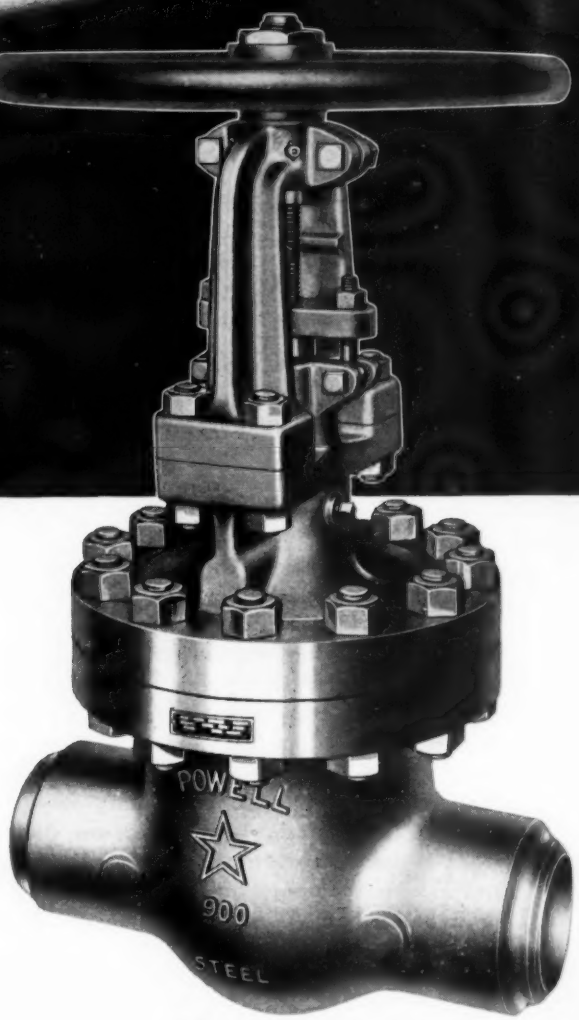


Fig. 9003 WE

POWELL

In the all-important field of Power, Powell Valves are famous for Dependability

It's not by accident that Powell Valves have an outstanding reputation for dependable performance in the vast field of Power.

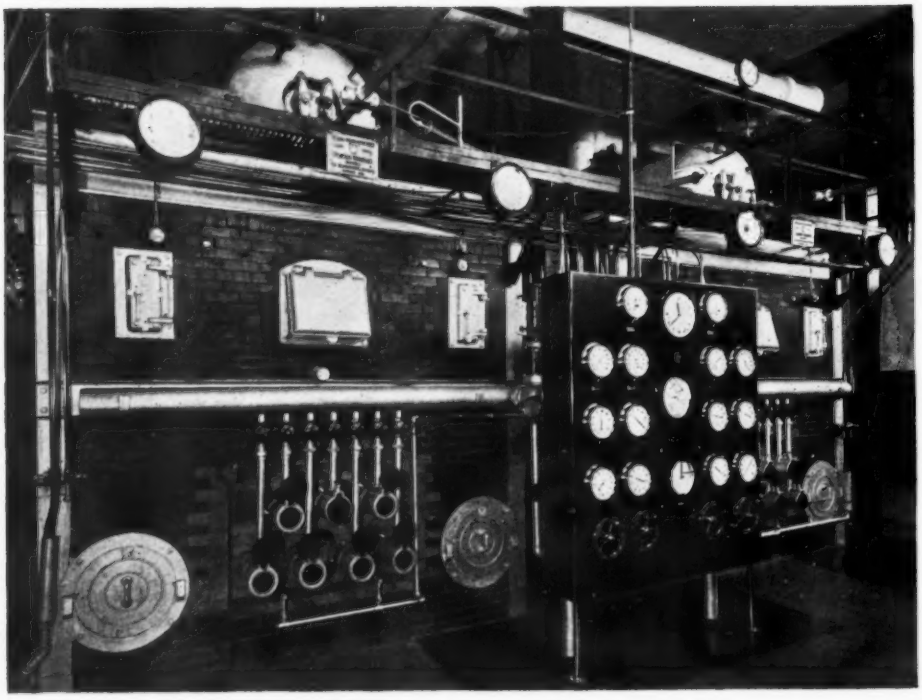
There's a lot of truth in the trite old saying that "practice makes perfect." For nearly a century Powell has concentrated on making valves—*and nothing but valves*. And through the years Powell Engineering has always been on the job—meeting and satisfying every new demand for valve design and construction.

The Wm. Powell Company

Dependable Valves Since 1846

Cincinnati, Ohio

VALVES



Boiler fronts of the two original gas fired "S-A" boilers at Calgary. The instrument panel between the boilers reports operating conditions throughout the hospital system including laundry, sterilizers and fire system, as well as recording meters on boiler performance.

3rd "S. A". Unit in 14 Months!

Two "S-A" boilers of 10,000 lb. per hour capacity were installed at the General Hospital in Calgary, Alberta in 1941. They were designed for a pressure of 150 lb. per sq. in. and have frequently operated at 190% of rating. In regular service they show nearly 5% increase in efficiency over the estimated figure.

Performance has been so eminently satisfactory and the Foster Wheeler "S-A" design fits wartime requirements of "maximum steam from minimum materials" so precisely, that when increased steam demands made an extension necessary, a third "S-A" boiler—a duplicate of the two already in service—was ordered for the Calgary General Hospital.

The Army-Navy Production "E" has been awarded to Foster Wheeler in recognition of quality equipment, in quantity, on time.

FOSTER WHEELER CORPORATION • 165 BROADWAY • NEW YORK, N. Y.

FOSTER WHEELER

INTO THE HANDS OF FIGHTING MEN

J&L MEN ARE PUTTING MORE AND BETTER FIGHTING STEELS 24 HOURS EVERY DAY 7 DAYS A WEEK

JONES & LAUGHLIN STEEL CORPORATION

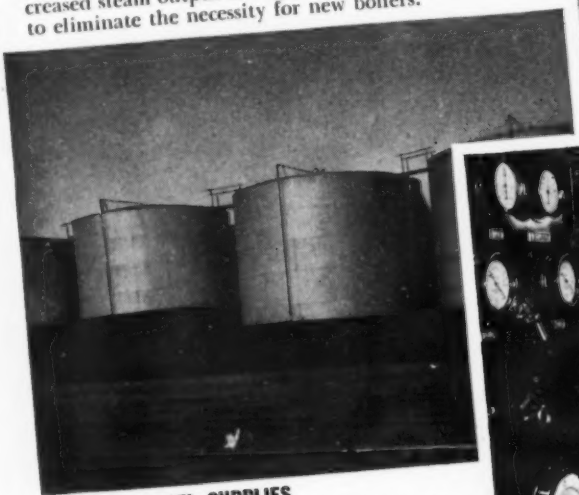
PITTSBURGH, PENNSYLVANIA

CONTROLLED QUALITY STEEL FOR WAR

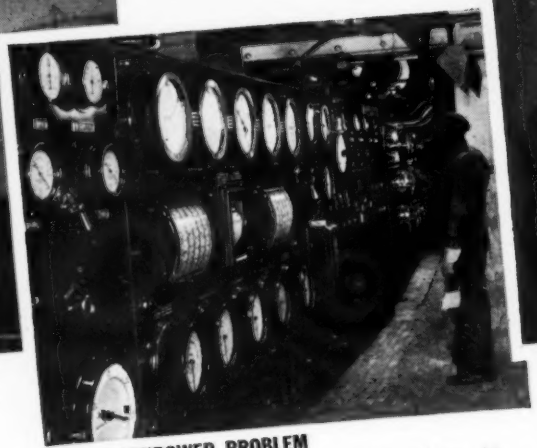
J&L STEEL

Our Hagan investment

STEPS UP STEAM OUTPUT
Hagan Automatic Combustion Control has often increased steam output enough to handle peak loads and to eliminate the necessity for new boilers.



STRETCHES FUEL SUPPLIES
Hagan-equipped plants are helping to reduce the fuel shortage.



HELPS MANPOWER PROBLEM
Hagan Automatic Control permits plants to operate at high efficiency with the minimum number of men. New men can be broken in easily because the operators are relieved of a myriad of duties.

STAR PERFORMER IN A BLACKOUT
Blackouts are no serious problem for a plant equipped with Hagan Control. The control can carry on by itself and allow the operators to take care of other duties.

Control was the best we ever made

- **It helped us lick the steam problem for war production.**
- **It will pay for itself over and over again in the years to come.**

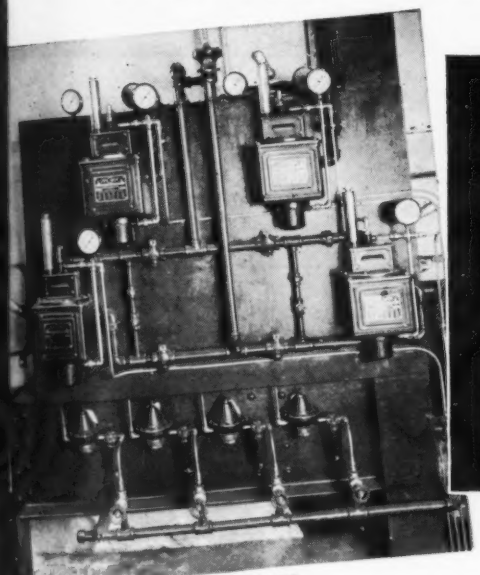
IT is not often you can make an investment that pays off in two ways, but here is one that thousands of Hagan users would tell you will.

For Hagan Control will not only meet your urgent need for increased steam efficiency *today*, but the economies it will effect in fuel consumption, labor and maintenance costs will pay rich returns for many years to come. No other type of equipment we know will write off its cost so quickly.

We can show you Hagan systems which have been giving good service so long we have almost forgotten when they were sold. We can tell you of hundreds of customers whose expansion through the years has included additional Hagan installations.

We are proud of these "old-timers;" they so fully justify our engineers' insistence on mechanical perfection.

Right now your plant is probably facing the severest test it has ever known or may ever undergo again. You are up against skilled labor and materials shortage. Satisfactory automatic control is a positive "must." These needs alone justify the investment. But Hagan Control will do more than satisfy today's need. Year in and year out its economies will pay off in never-failing dividends. Let us show you how.



STANDS UP UNDER WAR LOADS

Continuous high operation puts equipment to the severest kind of test and also proves the value of sound engineering design. We're proud of Hagan "old timers" that are coming through the war loads with very little need for maintenance.

HAGAN

Automatic COMBUSTION CONTROL

The pioneer . . . and still the leader

Specific advantages of Hagan Automatic Control

HAGAN
HALL
BUROMIN
CALGON

MAXIMUM QUANTITY of steam from any given plant, by introducing fuel and air in correct proportion for utmost efficiency.

MAXIMUM UTILIZATION value, uniform steam pressure and temperature, in accordance with demand.

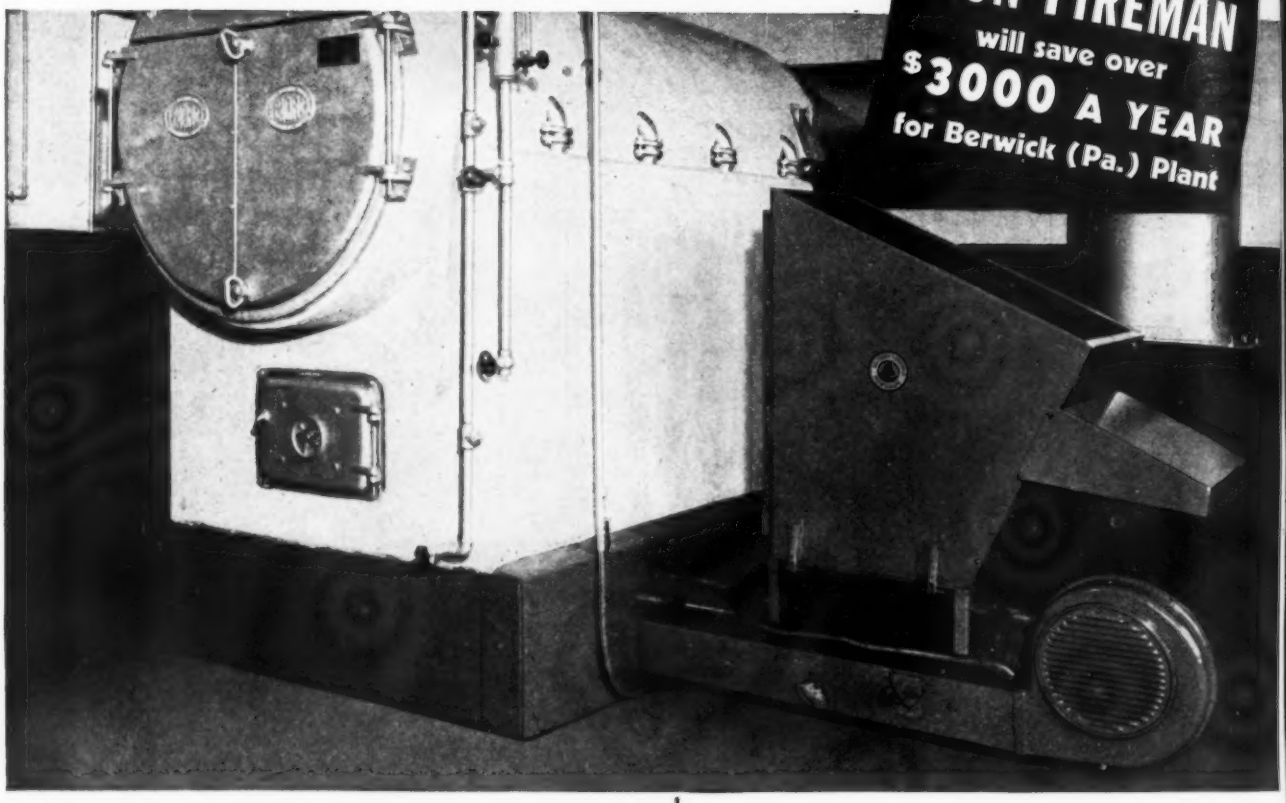
MAXIMUM OUTPUT from boilers of differing capacities, automatically.

MAXIMUM STEAM for production, by reducing loss of steam in frequent soot-blowing.

MAXIMUM PROTECTION of auxiliary equipment, fans, stokers, etc., by maintenance of uniform operating conditions.

HAGAN CORPORATION · HAGAN BLDG. · PITTSBURGH, PA.

Pennsylvania Plant Changes to Coal



Berwick Weaving, Inc., Switches to IRON FIREMAN Stoker Fired Coal

★ "The changeover from a restricted fuel to automatic coal reduced fuel bills at Berwick Weaving, Inc., $3,368.53 in 1942," says Charles C. Hertel, Jr., president. "Our 1942 coal bill for heating and process steam was $1090.47, whereas previous fuel bills amounted to $4459 for the same operations.

Charles C. Hertel, Jr.

"Iron Fireman firing is maintaining a *uniform* temperature—between 86° and 88° Fahrenheit and a relative humidity of between 63% and 65%, 24 hours a day, 7 days a week—necessary to the type of cloth manufactured at Berwick. Besides it provides steam 10 to 16 hours a day, 5 days a week, for a process machine which consumes 600 lbs. of steam per hour."

Iron Fireman Poweram at Berwick

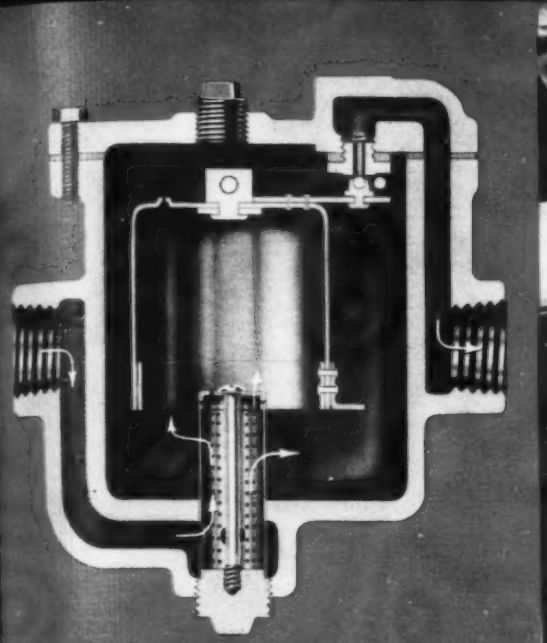
The clean-cut appearance of this Poweram installation has set a standard of cleanliness throughout the whole Berwick Weaving plant. The side installation keeps the boiler front clear. The Iron Fireman Poweram stoker, designed for heavy, continuous loads, combines *worm feed* with *ram distribution* of coal. The worm conveys the coal to the retort in a loose, aerated condition; reciprocating blocks distribute it evenly and prevent packing.

Today, in tens of thousands of boiler rooms, Iron Fireman coal stokers, burning an *unrestricted* fuel, are helping industries meet war needs by stepping up steam output 10% to 35%.

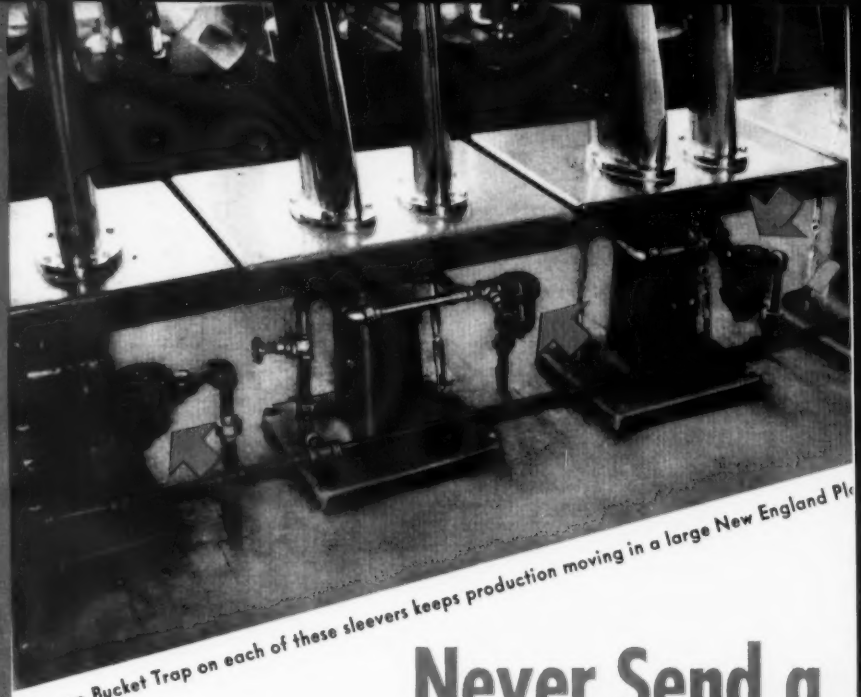
Easy to Change to Iron Fireman Coal Firing

If you are faced with fuel changes or increased steam loads, find out how quickly Iron Fireman equipment can be installed. Iron Fireman engineers are ready to make an immediate survey of your steam plant, no obligation. For free survey or complete catalog on the Iron Fireman Poweram, write or wire the Iron Fireman Manufacturing Co., 3350 W. 106th St., Cleveland, Ohio.

IRON FIREMAN AUTOMATIC COAL STOKERS



SARCO BUCKET STEAM TRAP
showing the built-in strainer and the straight-through connection, which save installation time and cost.



A Sarco Bucket Trap on each of these sleevers keeps production moving in a large New England Pl

Never Send a Boy to Do a Man's Job!

War is a man's job. Every man in industry, every boiler, every steam line and every steam coil is strained to the utmost. There's no time to train men, to add boilers, enlarge lines, insert more steam coils —but there is time and a way to increase their capacity 25 to 50% with Sarco Steam Traps and Control.

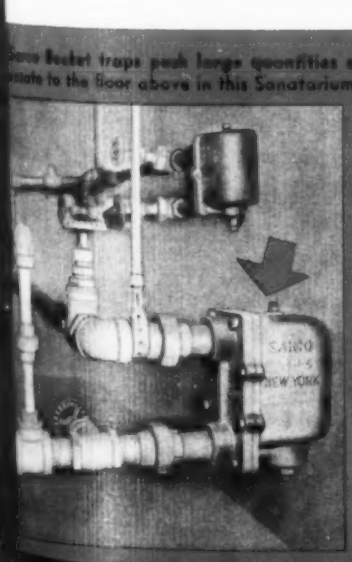
In many cases the steam trap that was O.K. yesterday is not the right kind of trap to do the man's job of today. It may be too slow, backing up condensate, reducing your output. Or it may be wasting too much heat. Or perhaps it is not letting the air out fast enough.

80% of the troubles due to incorrect temperatures can be solved by a simple Sarco steam trap or an inexpensive form of Sarco control.

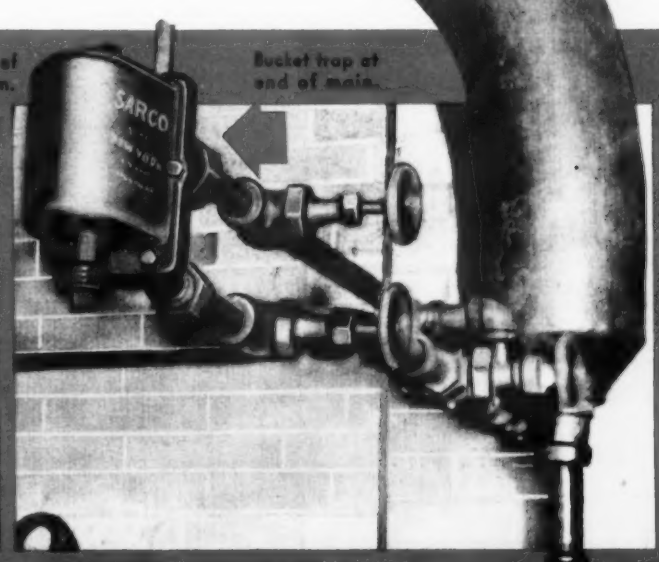
Sarco makes four widely different types of steam traps and eight distinct types of temperature control. Why not put it up to the nearest Sarco Representative to study your steam, hot water service and cooling problems and show you what could be done with Sarco Steam Savers?

Only one of the 12 essential Sarco Products is illustrated on this page. It's the Bucket trap — a bear for punishment, and a demon for speed, it is the mainstay of heavy heat users, where large volumes of condensate are generated continuously. The inverted bucket operates a heavy but simple mechanism of great power. The valve is protected by a strainer inside the trap. This trap can be equipped with air by-pass for rapid elimination of air and gas.

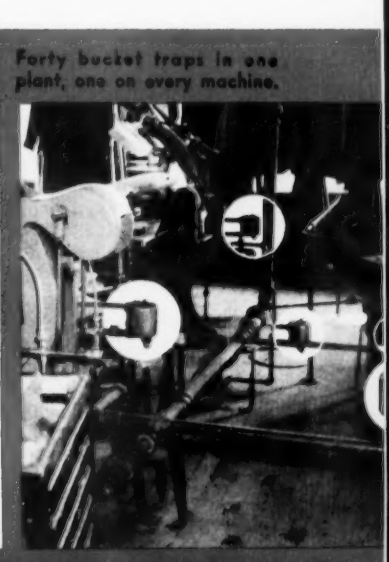
Standard types up to 250 lbs.
Special forged steel types up to 900 lbs. Catalog No. 350.



Sarco Bucket traps push large quantities of condensate to the floor above in this Sanatarium.



Bucket trap at end of main.



Forty bucket traps in one plant, one on every machine.

Low cost insurance

FOR EXPENSIVE EQUIPMENT

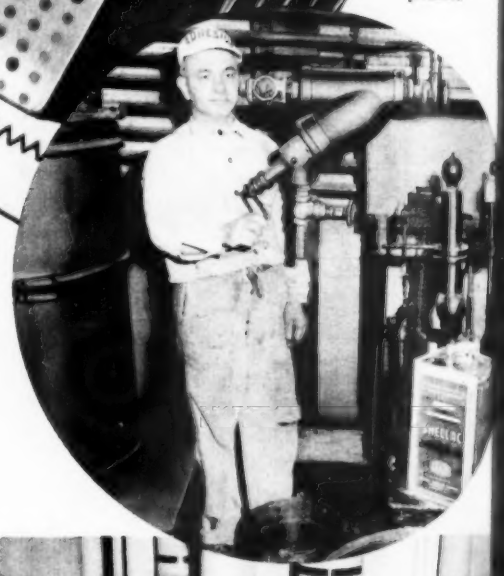
Clean liquids never clogged a pipe line, or caused delicate control and valve mechanisms to slow up.

It's just common sense to put a Sarco strainer in your lines ahead of every trap, valve, pump, burner or lubricator. They cost little, go in like a coupling, are cleaned in a jiffy by blowing through.

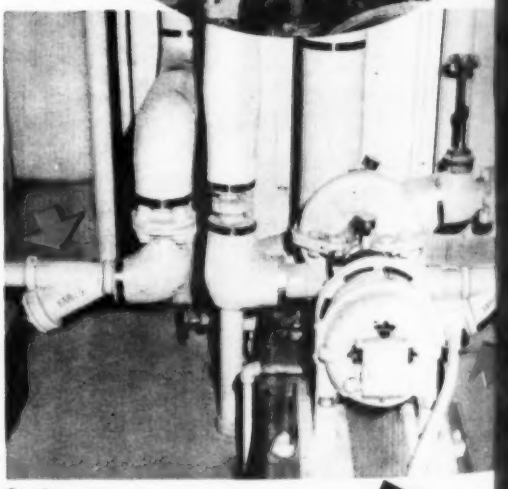
They are used extensively by the food, chemical and oil industries. Manufacturers of all kinds of machinery requiring the transfer of liquids buy them by the thousands to insure the satisfactory operation of their equipment.

Sizes range from ¼" up to 8" for all commercial pressures with screens for steam, water, oil, gas, brine, ammonia and other fluids. Sarco strainers equipped with a scraper for hand or motor operation are available for conditions where uninterrupted operation is necessary.

Order an assortment and put them in the line at the points where dirt, scale or other impurities cause shutdowns. Ask for Catalog No. 1200.



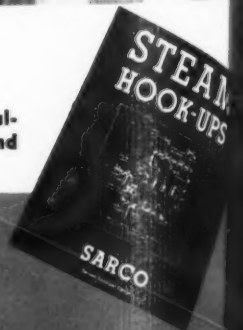
Scraper Strainer in varnish plant.



Strainers protecting pumps.

ASK FOR THE SARCO HOOK-UP BOOK

42 pages of diagrams, calculation data, tables and illustrations.



SARCO Saves Steam

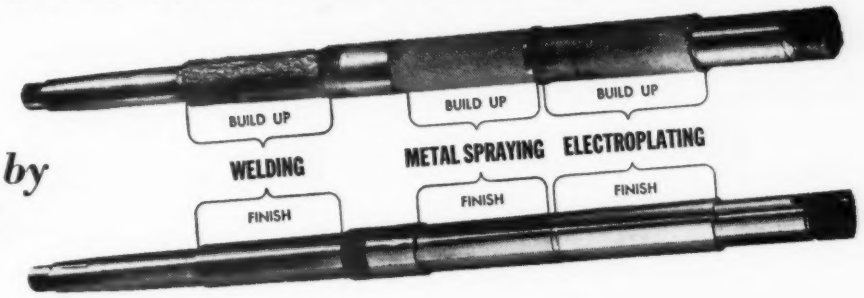
SARCO CANADA, LTD., 85 Richmond Street, West, TORONTO, ONTARIO

SARCO COMPANY, INC., 475 FIFTH AVENUE, NEW YORK

HOW TO GET MORE SERVICE FROM PUMP RODS AND SHAFTS...

PART 2–

Re-conditioning by building up and finishing



Putting worn pump rods, shafts and wearing sleeves back into shape usually may be done by machining and refinishing, as described in Part 1 of this series last month.

However, if too much metal must be removed to clean up the worn section, the shaft may be unduly weakened.

If a shaft shows a tendency to "whip"...or if a reciprocating pump rod tends to "bow" on pressure strokes, the pump manufacturer should be consulted. He may advise building up the shaft before machining.

If so, a choice may be made from three methods: *welding, metal spraying, or electroplating.*

Space does not permit a complete description of these operations, but the advantages of each method are given below.

Rods and shafts of Monel or "K" Monel can be built up for re-finishing by the methods given here. The excellent mechanical properties of the Monels provide an extra margin of strength, rigidity and toughness beyond the ordinary demands of normal work.

A bulletin, "New Parts from Old," that includes complete information on the above operations, together with the method of reconditioning by machining and refinishing described previously, will be sent on request.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street **New York, N. Y.**

ADVANTAGES OF WELDING

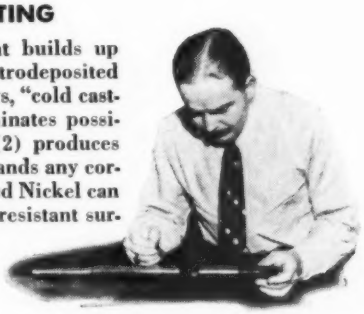
This method produces a stronger, tougher, more rigid shaft or rod than does spray coating or electroplating . . . and the mechanical properties of the rebuilt-by-welding shaft closely approach the mechanical properties of the original. Electric arc welding is preferred and the equipment required will be found in almost any maintenance shop.

ADVANTAGES OF SPRAY COATING

This is the simplest method of the three. For some purposes, the peculiar, porous structure of sprayed metal coatings is a drawback; it adds little tensile strength or toughness. However, in many shaft applications, this porosity is considered a virtue...the pores fill with lubricant in service which is believed to account for the increased working life of the part.

ADVANTAGES OF ELECTROPLATING

Another method is "cold casting" that builds up worn parts with heavy coatings of electrodeposited nickel. Although slower than other ways, "cold casting" offers these advantages: (1) eliminates possibility of heat distortion and warpage. (2) produces a dense fine-grained deposit that withstands any corrosive condition under which solid rolled Nickel can be used. (3) makes an extremely wear-resistant surface, as the hardness of the plating can be controlled to develop tempers ranging up to several times the hardness of the original pump rod or shaft.



SUGGESTIONS FOR OPERATING PUMPS TO PROLONG LIFE OF RODS AND SHAFTS

Use a good quality of packing recommended by a good packing manufacturer for the particular type of service.

•

Before putting in new packing, make sure that every particle of the old packing is cleaned out.

•

Tighten up the packing gland evenly, back off the nuts two or three turns, and adjust them finger tight.*

•

Make sure that the gland followers do not ride on the piston rods or impeller shaft.

•

To prevent burning of the packing and scoring of the shaft or sleeves in a centrifugal pump, a small amount of water should always seep out through the stuffing box while the pump is running.

•

Two ways to make packing last longer in centrifugal pumps are to use a light grease on the new packing and to cool the stuffing box externally until the packing is "run in" and some sealing water leaks through the box.

•

When packing becomes hard and dry, do not attempt to stop excessive leakage by tightening up further on the gland. Replace packing immediately.

•

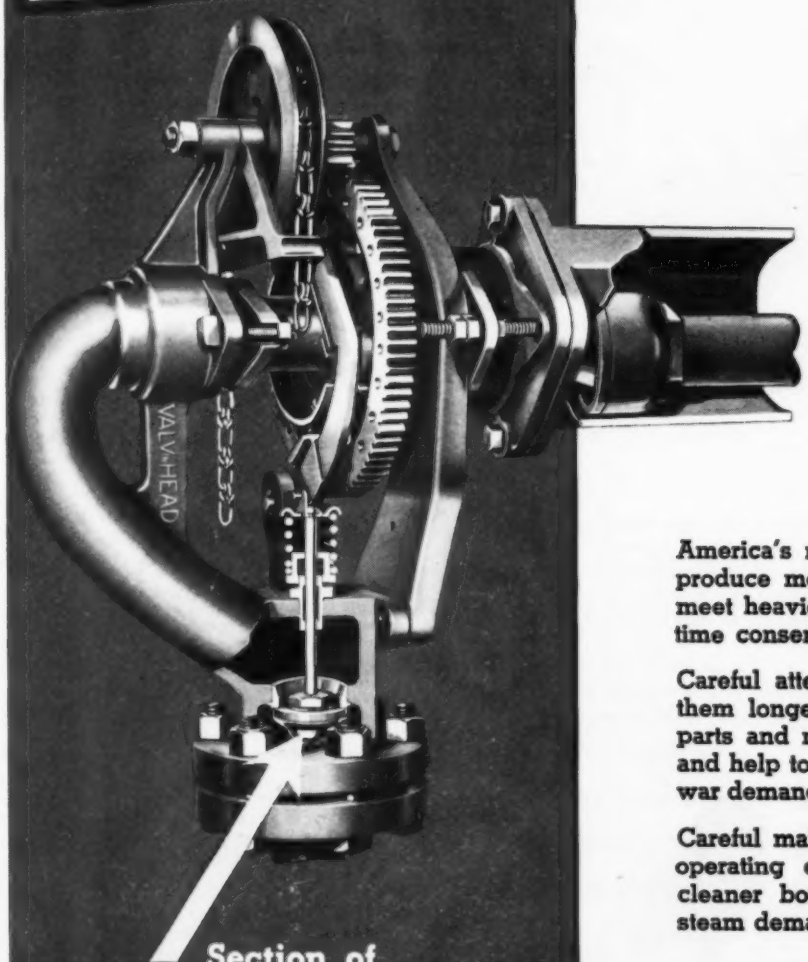
*Finger-tight is tight enough as long as the shaft or rod remains smooth and perfectly cylindrical. Shafts and rods of Monel or "K" Monel—with their qualities of high resistance to both corrosion and wear—tend to stay smooth and perfectly cylindrical longer.

★ ★ ★ ★ ★ **INCO NICKEL ALLOYS** ★ ★ ★ ★ ★

MONEL • "K" MONEL • "S" MONEL • "R" MONEL • "KR" MONEL • INCONEL • "Z" NICKEL • NICKEL

Sheet . . . Strip . . . Rod . . . Tubing . . . Wire . . . Castings

Get LONGER AND BETTER SERVICE FROM THE SOOT BLOWERS YOU HAVE



Section of
G9B SOOT BLOWER
Showing Poppet Valve

Care of

VALVES AND PACKING

SAVES STEAM

★

ASSURES EFFECTIVE BLOWING

★

America's march to victory demands that we all produce more—use less. You are called upon to meet heavier requirements for steam, at the same time conserving materials in every way possible.

Careful attention to your soot blowers will give them longer useful life—will conserve on repair parts and new blowers. It is economy for you—and help to us. We are called upon to meet heavy war demands, too.

Careful maintenance also keeps blowers in good operating condition at all times. The resulting cleaner boilers makes it easier to meet heavy steam demands.

Soot Blower Valves

All valve parts of Diamond G9B Soot Blowers are made of Monel metal or stainless steel. Under normal conditions they require very little attention for a long time. Oil should never be used on valve stems as it may form a gummy deposit

which may cause them to stick. In case a stem sticks, remove and clean it with emery cloth.

Should the valve need regrinding, remove gooseneck flange bolts, then remove cap screws which hold the bottom of the bracket to the gooseneck. Then remove the nut on the inner end of the sheave wheel shaft, which will permit drawing the gooseneck off the swivel tube without disturbing the packing. Take the gooseneck to a bench and regrind or replace the valve in the usual manner. Both valve disc and valve seat are renewable.

The valve may be reground without removing the head from the boiler. Remove the gooseneck flange bolts and the nuts on the end of the bracket stud. In this way, the entire unit may be pulled out and the gooseneck may be turned to a convenient position for regrinding the valve.

Soot Blower Packing

The G9B Soot Blower is packed around the swivel tube where it enters the gooseneck and also around the valve stem.

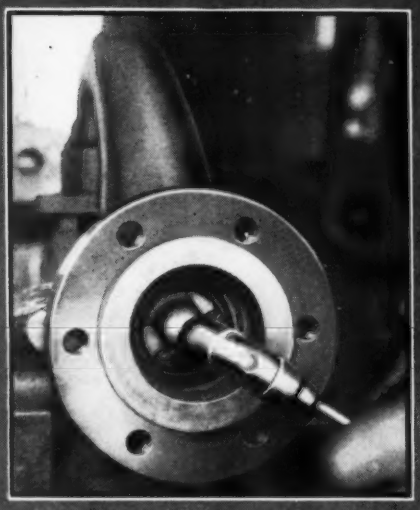
Special grade packing, made up in split rings of the correct size, is kept in stock at our factory.

If leaks develop which cannot be stopped by pulling up on the gland, add one or two rings of this special packing.

If it is necessary to repack the swivel tube gland, remove the gland bolts and pull out the gland far enough to allow insertion of new packing. Replace bolts, tighten as far as they will go. Remove gland again, insert an additional packing ring if possible and then back off the gland bolt nuts one-quarter to one-half turn so the packing will not bind the swivel tube.

To add or renew valve stem packing, remove the valve spring and unscrew the valve stem packing nut. The packing nut can then be filled with packing and replaced. Special tongs are available for removal of the valve spring.

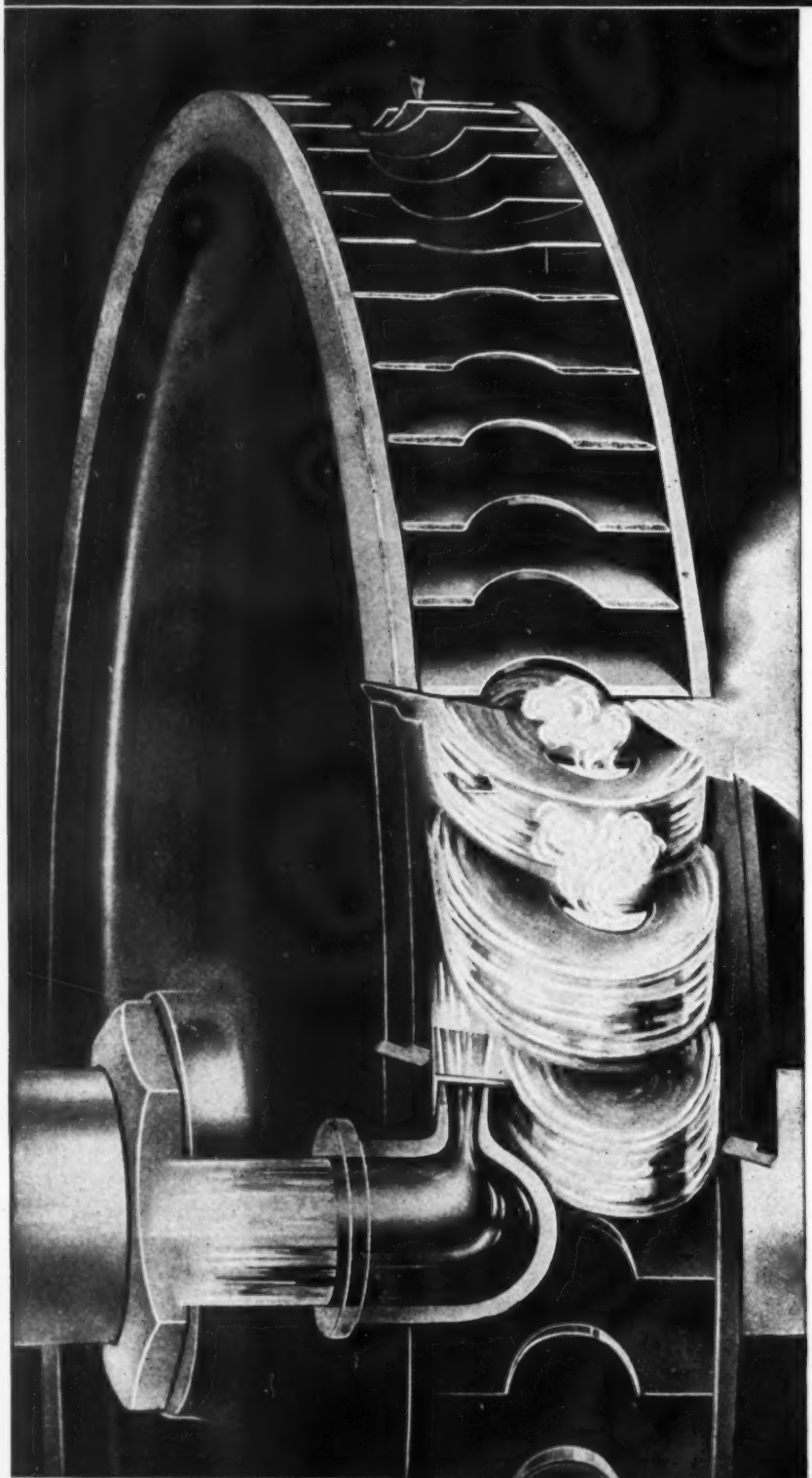
METHOD OF GRINDING
G9B SOOT BLOWER VALVE



Write
For This
Booklet
on Care of
DIAMOND
SOOT BLOWERS

DIAMOND POWER
SPECIALTY CORP.
DETROIT, MICHIGAN
DIAMOND SPECIALTY LIMITED • Windsor, Ont.

THROW YOUR
INTO
THE FIGHT



RELIABILITY FIRST!

Throughout the entire forty-nine years that the Terry Turbine has been on the market it has always been the Terry policy to build first of all for reliability.

That this policy has been appreciated is proven by the very extensive use of Terry turbines where only the most trustworthy apparatus is permissible, namely in outstanding central stations, leading industrial plants and on large Naval vessels. The Terry today still maintains that preeminent position in these most exacting fields which it immediately took upon its introduction.

At Left:—

Action of steam in Terry wheel turbine. The steam issues from an expanding nozzle at high velocity and enters the side of the wheel bucket in which its direction is reversed 180°. As this single reversal uses but a portion of the available energy, the steam is caught in a stationary reversing chamber and returned again to the wheel. This process is repeated several times until practically all of the useful energy has been utilized.

THE TERRY STEAM TURBINE CO.

Wheel Turbine

STEPS IN THE MACHINING OF A TERRY TURBINE WHEEL — From left to right:
1. Rough turned forging. 2. Smooth turned. 3. First milling cut. 4. Second milling cut. 5. Finished wheel.

TERRY WHEEL TURBINE ADVANTAGES

— The blades and the wheel are in one piece so that there are no parts to become loose or work out.

— The blades have large clearances.

— The blades are double rim protected.

— End play will not damage the blading.

— It is impossible for the blades to foul.

— The power producing action of the steam in the wheel takes place on the curved surfaces at the back of the buckets and, therefore, close blade clearance is not necessary.

— The only function of the blades is to form a series of pockets, wear of the blade edges is of little consequence and does not materially affect the horse power or efficiency. The important part of the bucket is the back or bottom which is a solid forging.

— There is practically no end thrust since the steam enters and leaves the wheel in a direction at right angles to the shaft.

ASK FOR BULLETIN S-116

T-1143

TERRY SQUARE - HARTFORD, CONN.

Scovill Tube News

Vol. 1 SCOVILL MANUFACTURING COMPANY, Waterbury, Conn. No. 2

Checking War-Time Tube Mortality By Study of Service Conditions

The Workmanship and Quality of the Tubes

The physical and metallurgical condition of condenser and heat exchanger tubes is relatively less important as a contributing factor of corrosion than the service conditions to which they are exposed. Nevertheless, deep scratches, seams, folds, unsoundness or other serious metal imperfections in tubes may initiate corrosion of a severe electro chemical type and should be avoided. A high standard of quality in the manufacture of tubes, therefore, is required to insure freedom from this source of trouble. Each step in the production of tubes from the selection of the raw material, through the casting, to the extrusion, drawing and annealing operations requires careful supervision. Metallurgical and chemical tests are necessary both on the finished tubes and on material in process. Close cooperation is maintained between manufacturing departments and the laboratory not only for necessary control work but also for developing new processes, new corrosion-resistant alloys or for any other work leading to the technical advancement in the manufacture and use of condenser and heat exchanger tubing. A discussion of this subject would not be complete without pointing out the excellent work done by various technical organizations in setting up high standards for the purpose of guaranteeing the quality of heat exchanger tubing. As an illustration, the specification covering Copper and Copper-alloy Seamless Condenser Tubes and Ferrule Stock issued by the American Society for testing materials, designation Bill 42, may be cited. This specification covers many essential requirements for the production of satisfactory and acceptable condenser tubes.

Conditions of Service

Heat exchanger tubes may be required to withstand or resist corrosion by various media under widely varying service conditions. The rate, form and intensity of corrosion of tube materials, and hence their period of service, depends upon the predominating or controlling factor or a certain combination of factors which may be found active for each individual installation. A study and appreciation of these factors as they apply to any particular corrosion problem is necessary not only in the selection of the most satisfactory and economical tube material, but in the proper control of such factors as may be required to extend tube life. The following list covers the most important of the factors which influence corrosion:

a. Temperature (tube-wall)
b. Velocity of media in contact with tubes
c. Hydrogen Ion Concentration
d. Oxygen Concentration
e. Composition of corroding media
f. Stresses acting upon tubes
g. Contact with dissimilar metals

The influence of each of the above factors is considered in the following paragraphs.

a. Temperature (tube wall)

Temperature plays an important part in all chemical reactions and hence, in all corrosion problems. The speed of all chemical changes is increased by raising the temperature and diminished by lowering it. Different reactions are affected in different degrees so that no simple rule can be given which will accurately define the effect of temperature. Roughly speaking, however, a rise of 10°C. doubles the speed of a reaction. Under actual service conditions, therefore, slight increases in operating temperature may accelerate corrosion to a marked degree and may be the deciding or major factor in short tube life. A rise in temperature of media in contact with tubes increases ionization, diffusion rates and the electrical conductivity of the solution, all of which may contribute to increased corrosion. On the other hand, an increased temperature may actually de-celerate corrosion in certain cases, due to such changes in the circulating media as a loss in oxygen or other gas concentration with rising temperature, or to the rapid formation of protective films, etc. An increase in temperature from 20°C. to 35°C. more than doubles the rate of corrosion of copper in either oxygen free or oxygen saturated, 6% (by weight) sulphuric acid solution. The corrosion of mild steel and of aluminum in both 6% by weight and 50% by weight of oxygen free or oxygen saturated sulphuric acid solution is, with one exception, very markedly accelerated by an increase of 15°C.

b. Velocity

The velocity or movement of the media in contact with tubes influences

Scarce metals saved by accurate Condenser and Heat Exchanger facts

Firms using Scovill's Service in Manuals find it possible to increase service life of tubes by seeing that engineers get all the facts on conditions of service, types of corrosion, selection of materials, etc. — contained in Scovill's complete "Condenser Tube Booklet", now available without charge to all tube users. The article on this page — No. 2 in a series of informative bulletins — is also available in re print form. Write Scovill Manufacturing Company, 13 Mill Street, Waterbury, Conn.

the rate of corrosion for the following reasons:

1. Increasing the rate of flow increases the amount of Oxygen carried to the surface of the metal.
2. Increasing velocity reduces the thickness of the liquid film at the metal surface and affects the type of corrosion products.
3. The rate of flow has been found sufficient in certain cases to cause actual mechanical erosion of metals particularly when the media carry large amounts of gritty or abrasive suspended materials.
4. High rates of flow tend to prevent the formation of concentration cells at the surface of the metal while low rates are favorable for their formation.

The turbulent flow of media through tubes is often closely related to relatively high velocity. Turbulence is often responsible for the formation of local cells at the tube surface which cause an intense local pitting. Turbulence of the circulating medium is also often responsible for the combined erosion-corrosion of tube surfaces. This form of corrosion is much greater when the water carries mechanically entrained air. Bengough and May in the Seventh Report of the Corrosion Research Committee of the Institute of Metals, J. Inst. Metals, 32, 1924, pg. 213 in their study of effect of velocity on the corrosion of condenser tubes concluded that very turbulent flow and medium sized bubbles appear to be most active in this respect. Generally speaking, an increase in the velocity of media through or around tubes produces a corresponding increase in the rate of corrosion. In a 6% by weight air saturated sulphuric acid solution, the corrosion rate of Copper is doubled where the velocity is increased from a still solution to 4.3 ft. per second. Similar tests in 6% (by weight) air saturated hydrochloric acid Solution show a tenfold increase in the corrosion rate of copper. Some information may be gained regarding the variation in velocity of the circulating water through the tubes of steam condensers from the following data published in Progress Report No. 6 of the A.S.M.E. Special Research Committee on Condenser tubes:

1. From 2.6 to 9.4 feet/sec. for salt water installations, with an average value of 5.9 feet/sec.
2. From 2.5 to 9.9 feet/sec. in fresh water installations, with an average value of 5.6 feet/sec.

c. Hydrogen Ion Concentration

The acid properties of solutions are due entirely to hydrogen ions, the alkaline properties to the hydroxide ions. Strong acids are those which are highly dissociated in solution and give a large number of hydrogen ions; weak acids, on the other hand, are those which are but slightly dissociated in solution and give relatively few hydrogen ions. A knowledge of the hydrogen ion concentration of solutions is of more importance in corrosion problems in most instances than that of the total acidity. The method of expressing hydrogen ion concentration most generally in use is by means of the term "pH". The pH value is the logarithm of the reciprocal of the Hydrogen ion concentration. Expressed by an equation it is written thus: $pH = \log \frac{1}{(H\ell)}$

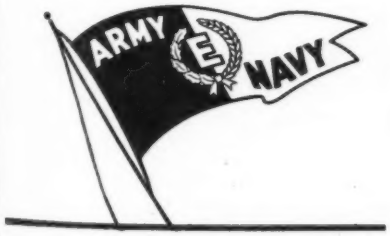
The neutral point on the pH scale has a value of 7.0. Values below 7.0 such as 6.0, 5.0, etc., denote acidity, the degree of acidity increasing as the numbers decrease. A solution having a pH value of 6.0 contains 10 times as many hydrogen ions as one having a pH value of 7.0 and a solution of pH 5.0 contains 100 times as many H ions as one of pH 7.0. Values above 7.0 such as 8.0, 9.0, etc., denote alkalinity, the degree of alkalinity increasing as the numbers increase. This explanation can be easily understood from the following tabulation of pH values:

Acid													
etc.	4.0	4.5	5.0	5.5	6.0	6.5							
Neutral													
	7.0												
Alkaline													
	7.5	8.0	8.5	9.0	9.5	10.0	etc.						

Solutions which are acid in character are usually more corrosive towards metals than solutions which are neutral and the neutral solutions are more corrosive than alkaline solutions. In the presence of oxygen or of oxidizing materials, corrosion in acid solutions may be greatly accelerated.

The pH value in itself is no measure of the corrosiveness of a solution. Two solutions of the same pH value may differ widely in their action on metals, depending both on the actual compounds influencing the pH value and on the presence or absence of other salts, gases, etc., in the solution. As an example, a solution containing 0.05 moles of ammonium hydroxide per liter and a solution containing 0.001 moles of sodium hydroxide per liter would have approximately the same pH value (11.00) but corrosion of non-ferrous alloys would be more severe in the ammonium hydroxide solution. Furthermore, the presence of an active oxidizing agent in the ammonium hydroxide solution would further accelerate corrosion at the same pH value. While no definite prediction can be made of the behavior of metals in solutions of a stated pH value, this measure of the degree of acidity or alkalinity is of value, when considered with other factors and service conditions in a correct interpretation of corrosion problems.

Other conditions affecting heat exchanger tubes will be discussed in the next issue of "Tube News".



Limitation order L-154 issued by the OPM. This order limits the use of non-ferrous condenser tubes in land power stations to Muntz metal for fresh water plants, and Admiralty metal for salt water plants. No non-ferrous metals containing more copper and more tin than these two are permitted by the order.

Scovill
MANUFACTURING COMPANY
WATERBURY, CONN.

SCOVILL CONDENSER TUBES

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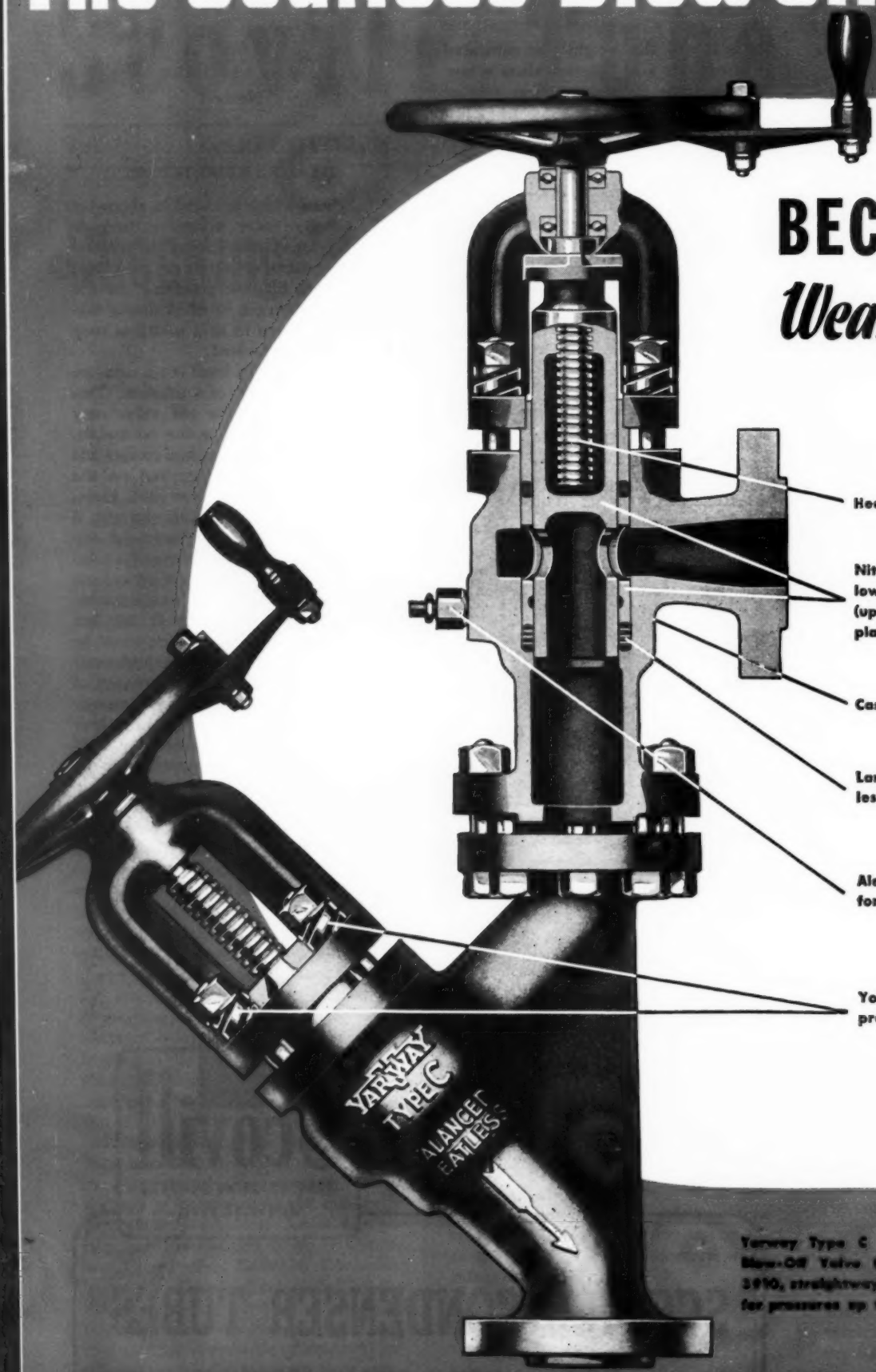
Service in Manuals... Service in Metals... Service in Men

The Seatless Blow-Off Valve

BECAUSE ★ ★ ★

Wear and Clog wit



Heat-treated steel stem.

Nitralloy Plunger and lower Follower Gland. Brinell hardness 1100 (upper Follower Gland, chromium plated steel).

Cast Steel Body and Yoke.

Laminated packing ring with stainless steel reinforcing inserts.

Alemite lubrication of Plunger (also for ball thrust bearings in yoke).

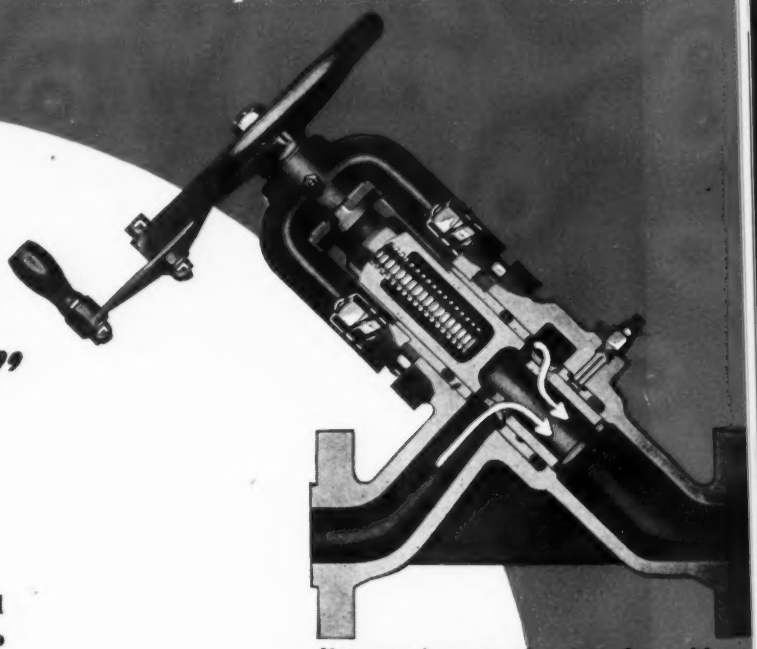
Yoke Springs maintain required pressure on packing at all times.

Yarway Type C Seatless Tandem Blow-Off Valve (angle valve Fig. 3910, straightway valve Fig. 3911) for pressures up to 600 lbs.

YARWAY

"Standard" in Over 12,000 Plants

"No Seat to *Score, Mud, Scale and Dirt*"

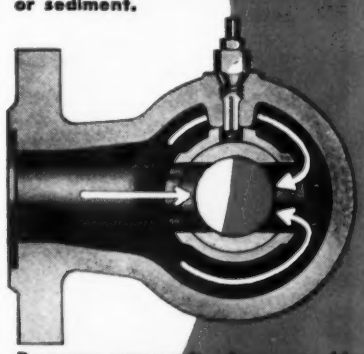


Note ample space for free flow with no projections or pockets to accumulate scale or sediment.

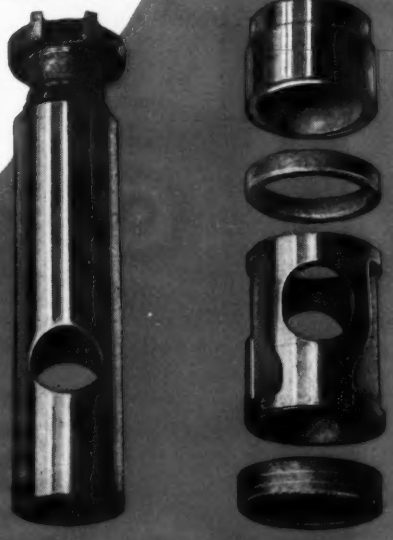
More than a quarter century ago, Yarway introduced their Seatless Blow-Off Valve and said—"No seat to score, wear and clog with mud, scale and dirt." Power plant operators, harassed by continuous trouble and expense with conventional valves—welcomed the Yarway as the answer to their troubles . . . purchased them, watched them, standardized upon them. And the Yarway Seatless design, in a relatively short time, became the most widely preferred blow-off valve.

Today, after a quarter century of service, it still holds that distinction. Sound fundamental design...coupled with continuous mechanical and metallurgical research anticipating ever-new service requirements . . . makes the highly improved Yarway Seatless Valve of today just as good insurance against blow-down trouble and expense in today's plants as it was in the plants of twenty-five years ago.

There is a Yarway Valve for every pressure and purpose. Write for Catalog B-422 for pressures up to 400 lbs. Catalog B-431 for higher pressures.



Pressure surrounds plunger making a fully balanced valve, easy to operate regardless of pressure.



Nitrulloy plunger and lower follower gland, and laminated packing with stainless steel inserts, add years to valve life.

YARNALL-WARING COMPANY
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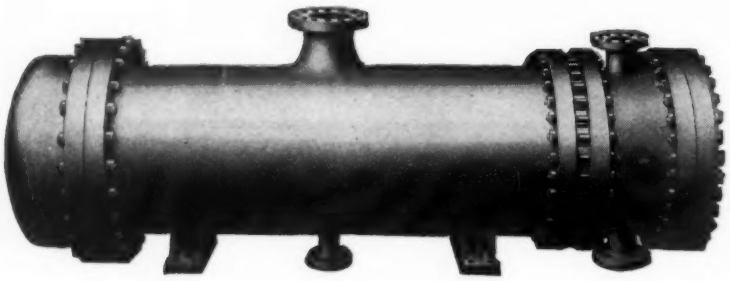
BLOW-OFF VALVES

FEED WATER HEATER EQUIPMENT

for High, Intermediate, or Low Pressure Service



Lummus-designed and Lummus-built boiler feed water heaters are operating at pressures as high as 1200 pounds per square inch. Numerous Lummus units are in service in the intermediate and low pressure fields.

Lummus heat exchangers are available in all pressure ranges employed in modern power plants. Lummus heat exchanger equipment also includes Surface Condensers, Steam Jet Air Pumps, Fuel Oil Heaters, Lubrication Oil Coolers.

Lummus engineering personnel and construction facilities are available to public utilities and industrial power plants requiring equipment to meet specific conditions. Write for further information.

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The New GOODYEAR STEEL CABLE V-BELT

tackles forbidden fields on "belt eater" drives

SCORE another first for Goodyear—a revolutionary improvement in V-belt construction that obsoletes previous conceptions of V-drive design limitations.

The higher power capacity of steel cables now makes it possible to employ Multi-V drives where engineering limitations formerly denied their use. You can now pull heavier loads or get longer life on your present drives. It makes it practical for you to go to slower speeds or design a more compact drive, often eliminating outboard bearings.

In addition practically zero stretch means a new absolute minimum in adjustment and maintenance shutdowns. This freedom from stretch insures truly uniform performance from every belt in the drive. Once matched, always matched—there can be no loafers. This means far longer belt life.

Proved In Action

An endless steel cable replaces conventional cotton cord as the load carrying member in this remarkable new V-belt recently perfected by Goodyear after years of experimental work. In checking hundreds of thousands of drives for E-C Cotton Cord V-Belts the G.T.M.—Goodyear Technical Man—found many drives incapable of being handled by conventional belts. Many of these drives now may enjoy wire V-belt advantages.

On fan and pump drives of U. S. Army tanks and combat cars where ordinary V-belts "burn out" in a few hours, the new Goodyear Endless Steel Cable V-Belt takes the grueling punishment with a margin of safety. In industry, handling "belt eater" drives, it is proved that this new belt is far superior to any belt ever designed.

Goodyear Steel Cable V-Belts are now available to war industries holding top priority. Present emergency naturally limits the quantity and type, but if you have a troublesome drive, consult the G.T.M. or write the complete story to Goodyear, Akron, Ohio, for information.

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LESS STRETCH
BETTER FLEX
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THESE RESULTS JUSTIFY
IN A-E-CO TAYLOR

PROBLEM: The manufacturing plant concerned is located in an area adjacent to fields offering coals of widely diversified burning characteristics. The problem, therefore, was to select fuel firing equipment that could take advantage of most favorable situations under fluctuating market conditions, and at the same time deliver maximum efficiency and reliability.

SOLUTION: Comparison of many possible combinations of equipment led to the choice of a modern Taylor Continuous Ash Discharge Stoker-fired Steam Generator. The completed unit consisted of a Taylor Stoker driven by an integral steam turbine—all under a 472 H.P. straight tube boiler with vertical side and rear water-walls. Relatively low cost of coal precluded the necessity for heat recovery equipment.

RESULTS: The unit was placed in service in 1940. Since the first day of operation the overall efficiency has averaged 79.8% without heat recovery devices. Records of performance dating from December 25, 1940 to September 8, 1942, reveal 206,286,000 lbs. of steam generated while burning 20,030,000 lbs. of coal. Average actual evaporation was 10.3 lbs. coal/lb. steam. Average gauge pressure 214 lbs. Average steam temperature 510°F. Average feed water temperature 224°F. Average B.T.U. per lb. coal as fired 13,900. Steaming rates ranged from 10,000 to 34,000 lbs. per hour.

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*Aluminum Company of America, New Kensington, Pa.
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Castanea Paper Company, Johnsonburg, Penna.
Chrysler Corporation, DeSoto Plant, Detroit, Mich.
*Collins and Aikman Corp., Roxboro, N. C.
City of Columbus, Ohio
*Consolidated Paper Company, Monroe, Michigan
*Cresson State Sanitarium, Cresson, Penna.
Defiance Milk Products Co., Defiance, Ohio
*DeLaval Steam Turbine Co., Trenton, N. J.
*Detroit Sulphite Pulp & Paper Co., Detroit, Michigan
City of Dover, Ohio
*Draper Corporation, Hopedale, Mass.
Erwin Cotton Mills Co., West Durham, N. C.
*Fisher Body Corporation, Detroit, Michigan
Fisher Body Corporation, Fleetwood Plant, Michigan
*Fisher Body Corporation, Grand Rapids, Michigan
*Fisher Body Corporation, Pontiac, Michigan
Fox Paper Company, Lockland, Ohio
Froedtert Grain and Malting Co., Milwaukee, Wisc.
*City of Galion, Ohio
*Gardner-Richardson Company, Lockland, Ohio
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*General Electric Company, Fort Wayne, Ind.
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*City Water & Light Plant, Jonesboro, Ark.
Kohler Company, Kohler, Wisc.
Maryland State Penal Farm, Roxbury, Md.
*Marbury Sanitarium, Northville, Michigan
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*Michigan State College, East Lansing, Mich.
Municipal Light Plant, Marshfield, Wisc.
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*Packard Motor Car Co., Detroit, Michigan
*Municipal Electric Plant, Painesville, Ohio
*Park Drop Forge, Cleveland, Ohio
*Pennsylvania Electric Co., Seward, Penna.
*Pennsylvania R. R. Co., Philadelphia, Penna.
*Picatinny Arsenal, Dover, N. J.
*Pittsburgh Plate Glass Co., Barberton, Ohio
Borough of Quakertown, Quakertown, Penna.
Raleigh Wyoming Mining Co., Glen Rogers, W. Va.
*Rhinelander Paper Company, Rhinelander, Wisc.
City of Richland Center, Wisconsin
*City of Richmond, Indiana
Sayles Biltmore Bleachery, Biltmore, N. C.
Scotten Dillon Company, Detroit, Michigan
Shelby Cotton Mills, Shelby, N. C.
Sloane-Blabon Corp., Philadelphia, Penna.
*Solvay Process Company, Detroit, Michigan
*St. Elizabeth's Hospital, Washington, D. C.
City of St. Bernard, Ohio
Swarthmore College, Swarthmore, Penna.
*Timken Roller Bearing Co., Canton, Ohio
Timken Roller Bearing Co., Gambrinus, Ohio
Municipal Water & Light Plant, Tippecanoe City, O.
City of Toledo, Ohio
*Union Bleachery, Greenville, S. C.
Union Mills Paper Mfg. Co., New Hope, Penna.
*University of Wisconsin, Madison, Wisc.
*Vassar College, Poughkeepsie, New York
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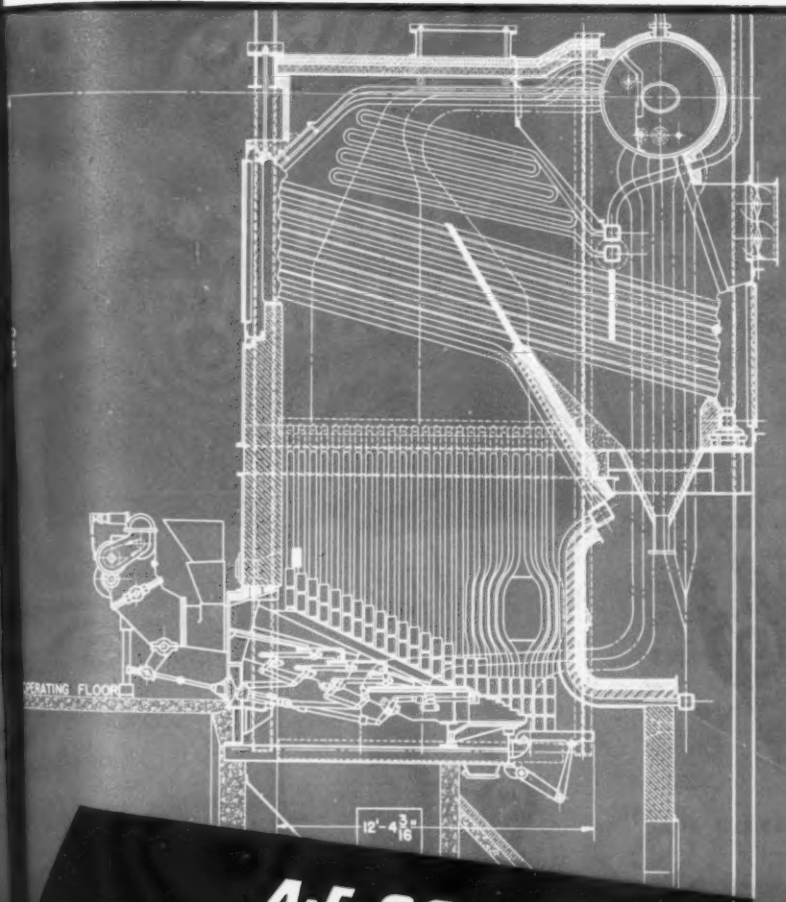
Warfield Natural Gas Company, Harold, Kentucky
White Sewing Machine Co., Cleveland, Ohio
Whiting Plover Paper Company, Stevens Point, Wisc.

(*) *Represents repeat orders.*



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12. **OBSOLESCENCE**—the adaptability of the equipment toward possible future modernization with minimum of complication and outage.

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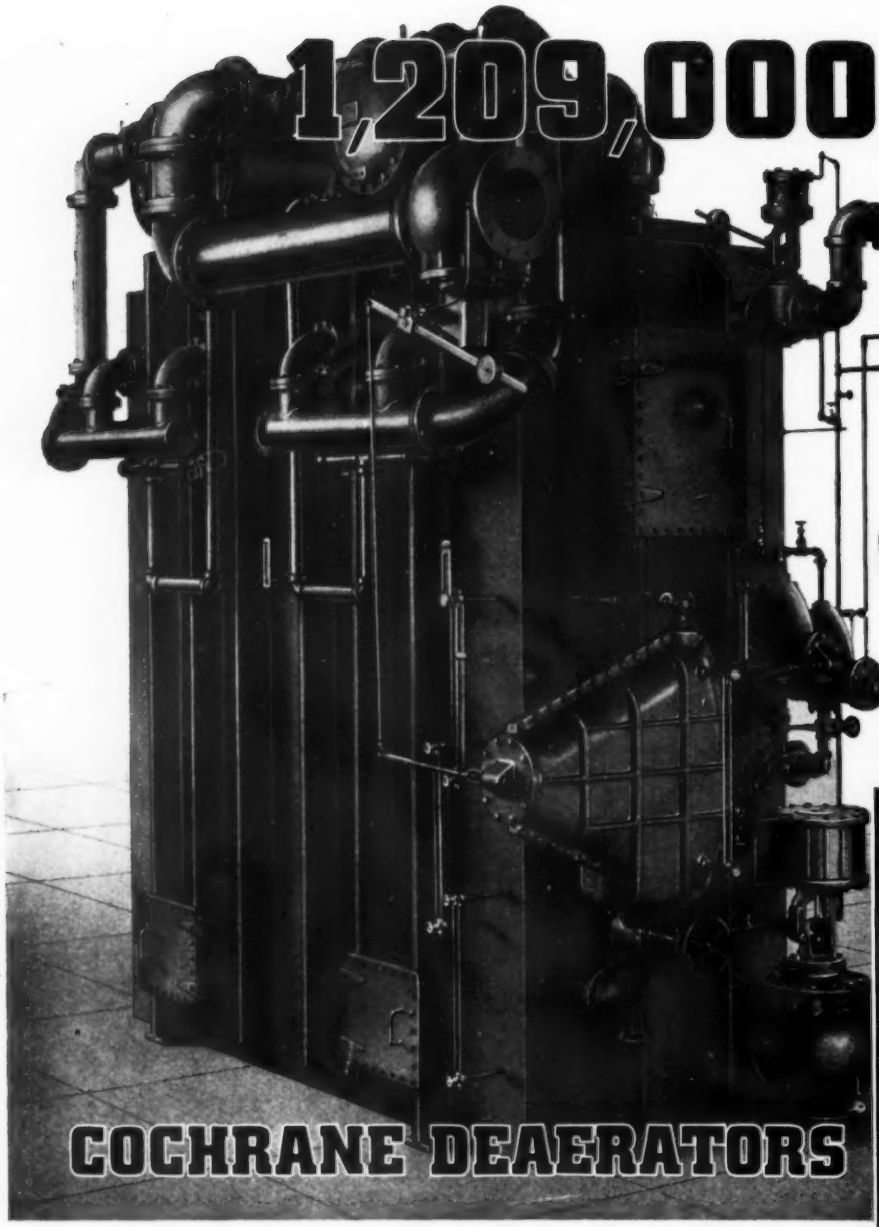

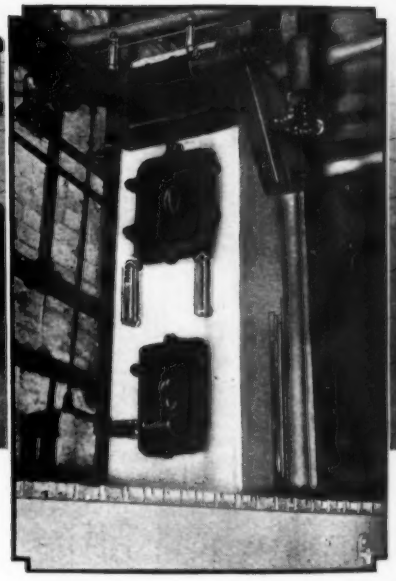

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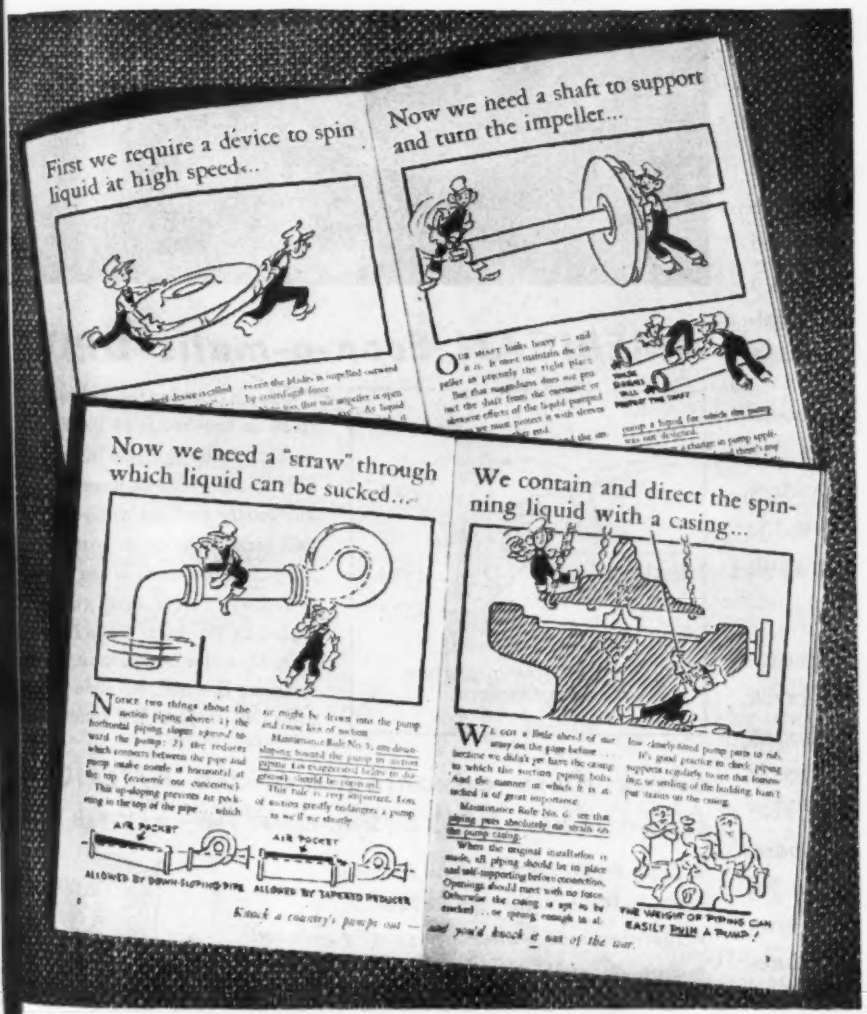
First we require a device to spin liquid at high speed...
Now we need a shaft to support and turn the impeller...
Now we need a "straw" through which liquid can be sucked...
We contain and direct the spinning liquid with a casing...
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AIR POCKET
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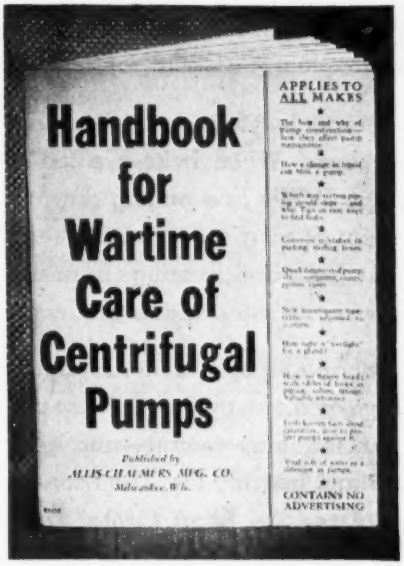
HERE'S THE REASON most pre-war pump maintenance literature is seriously out of date today: *pumps that used to work 1800 hours a year are now working 8700 hours a year.*

Another reason: America can no longer *afford* unnecessary pump failures or lowered efficiency!



In Allis-Chalmers' new centrifugal pump maintenance book a pump is *built* . . . giving fresh, new insight into the kind of care a pump needs in *wartime.*

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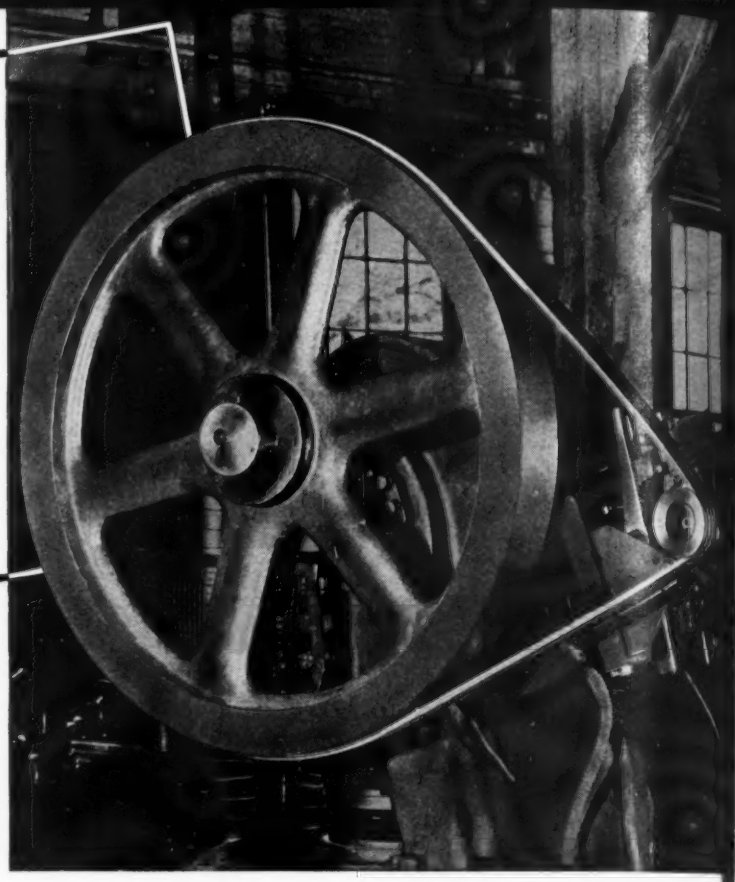
A-1576-3

"9 Hours Output in Each 8-Hour Shift"

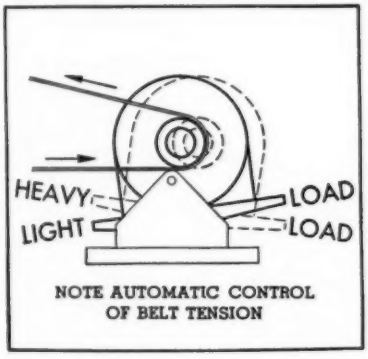


• • • reports one manufacturer who adopted American Econ-o-matic Short Center Drives for his punch presses. The gain in output resulted from reduced belt slippage—thus sustaining the RPM speed at correct level—and eliminating frequent "time-outs" for adjusting belt tension.

Improper belt tension creates many troublesome problems. When belts are too loose, you are losing RPM's and cutting down the productive output of your machines. When tension is too tight, belts and bearings burn up, forcing shutdowns and interrupting production.

By changing over to an American Econ-o-matic Drive, you can overcome these problems—boost your machine output—and greatly increase belt and bearing life. The Econ-o-matic Drive is an American Short Center Drive, either Flat belt or V-belt, with an Econ-o-matic motor base that gives you *automatic* belt tension control. No more worry about belts too tight or too loose—no lost RPM's—no slippage—no unnecessary "time-outs" to make frequent manual adjustments, after you install American Econ-o-matic Drives.

AMERICAN Econ-o-matic DRIVE



NOTE AUTOMATIC CONTROL OF BELT TENSION

The *load* governs the belt tension. Here is the heart of the Econ-o-matic Drive . . . the American Econ-o-matic Motor Base. It *automatically* and *instantly* matches belt tension to each variation in the pull of the load. When the load is *heavy*, motor base *pulls* and *tightens* the belt. When the load is *light*, motor base *slackens* and *loosens* the belt. No slide rails or idlers to adjust. It's *automatic!*

Check these advantages of the AMERICAN Econ-o-matic DRIVE (Short-center Flat — or V-Belt Type)

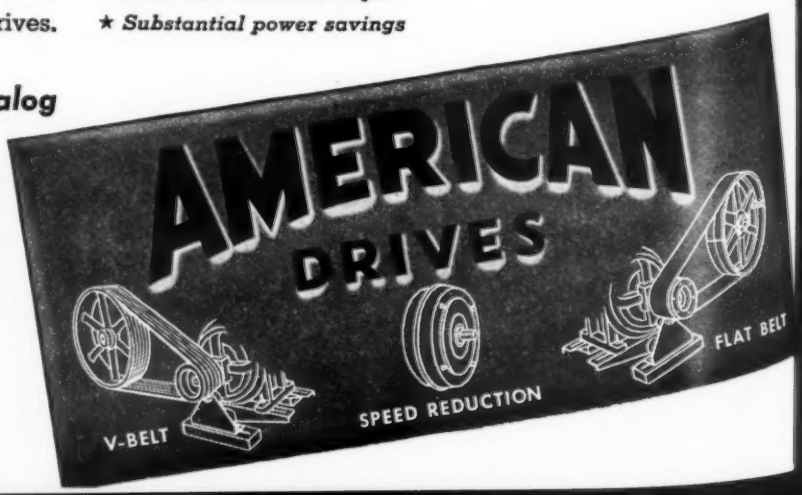
- ★ *Longer life for belts and bearings*
- ★ *No belt slip—no lost RPM's*
- ★ *Maintenance man-hours greatly reduced*
- ★ *Smooth, cushioned starting*
- ★ *Increased machine output*
- ★ *Substantial power savings*

Navy "E" for excellence awarded February 12, 1942

Get This New Econ-o-matic Catalog

36 pages of helpful Information that shows you how to solve drive maintenance problems—how to increase belt and bearing life—how this drive can help you increase machine output. This catalog provides you with complete information on American Econ-o-matic Drives, and shows how to select the right drive for your purpose. Send for your copy. Write now.

The American Pulley Company
PHILADELPHIA, PENNSYLVANIA

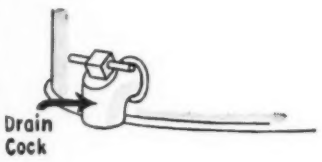


How to make Acetylene Generators last longer and work more efficiently...

Acetylene generators are a convenient and economical source of acetylene gas for use in the oxy-acetylene process. When operated and maintained in accordance with the manufacturer's instructions, a good generator should function safely and efficiently indefinitely. A few suggestions are outlined here to help you keep your generator working its best for a long time.

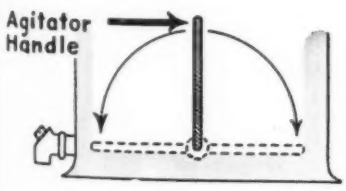
WHEN RECHARGING

1. ***Always change the water*** whenever a generator is to be recharged, and replace it with clean, cool, water. This will



guard against a rise in temperature within the generator to an abnormal level that would affect the safety and efficiency of operation.

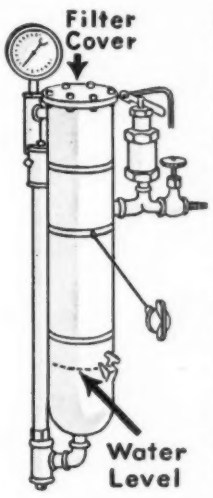
2. ***Operate the residue agitator*** while draining the generating chamber. This



will help assure thorough removal of the residue.

3. ***Flush the generating chamber*** with clean water after draining off all the residue. If this is not done, the lime deposit will build up so that the amount of water that can be put into the generating chamber is considerably reduced. In addition, the caked deposit will make difficult operation of the residue agitator, and will slow up recharging by partially plugging the drain cock.

4. ***Check the hydraulic*** water level each time the generator is recharged, and add water to the correct level if needed. This is important to assure protection to the generator in case of a flashback of flame.



MAINTENANCE SUGGESTIONS

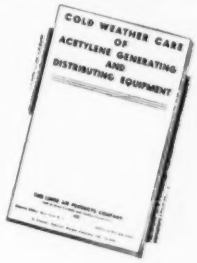
5. ***Clean filter pads*** should be installed at regular intervals. This is necessary not only because dirty pads may restrict the flow of acetylene, but also because they permit entrained moisture and small particles of lime to be carried over into the hose and apparatus.

6. ***Test for leaks*** with soapy water at periodic intervals, particularly around gaskets—and always immediately after a gasket has been replaced. This is important not only because leaks represent a serious hazard, but also because gas leaks are costly.

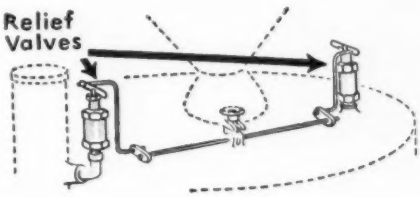
7. ***Prevent rust*** on the outside of the generator by painting it or touching up bare spots whenever needed.

FOR SAFETY'S SAKE

8. ***Prevent freezing*** of water in any part of the generator, as freezing may destroy its usefulness and will in many cases present serious hazards. The book illustrated here will help you to do this. Copies may be obtained from any Linde Office, without charge.



9. ***Relief valves*** should be kept in good operating condition at all times, and set



to release at the pressures recommended by the manufacturer.

10. ***Do not remove*** permanently any part of the generator mechanism. Each part is specifically designed to help assure safe and efficient operation.

11. ***Follow all instructions*** furnished with the generator. Duplicate instruction books for all Oxweld generators can be obtained from any Linde office without charge.

THE LINDE AIR PRODUCTS COMPANY

Unit of Union Carbide and Carbon Corporation

30 E. 42nd St., New York, N. Y. UCC Offices in Principal Cities

In Canada: Dominion Oxygen Company, Limited, Toronto

You Can Obtain Copies of this Advertisement For Distribution in Your Shops . . . or to Post on Your Bulletin Boards . . . Upon Request.

The words "Linde," and "Oxweld" are trademarks.

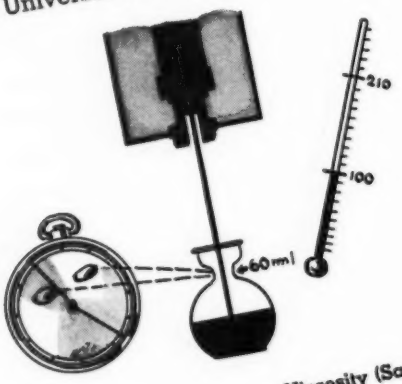
VISCO

TIDEWATER LUBRICANIA

DEFINITION: The resistance to distortion offered by a fluid, because of its cohesion or internal friction, is called Viscosity. A heavy bodied slow pouring liquid is high in viscosity.

TEST: The commercial instrument commonly used in the United States for determining viscosity of mineral lubricating oils is the Saybolt Universal Viscosimeter (S.U.V.). The viscosity, expressed in seconds (Saybolt Universal), is the time required for 60 milliliters of the liquid to flow through the standard aperture of the instrument at a stated temperature.

The Saybolt "Furol" Viscosimeter is often used in connection with very heavy oils. Multiply Furol seconds by 10 to obtain approximate Saybolt Universal seconds.



Examples	Viscosity (Saybolt Universal) at 100°F	at 210°F
Kerosene	32 sec.	
Light Machine Oils	150-250 sec.	40-50 sec.
Steam Cylinder Oils	2000-6000 sec.	150-250 sec.

INDUSTRIAL TYCOL OILS-GREASES

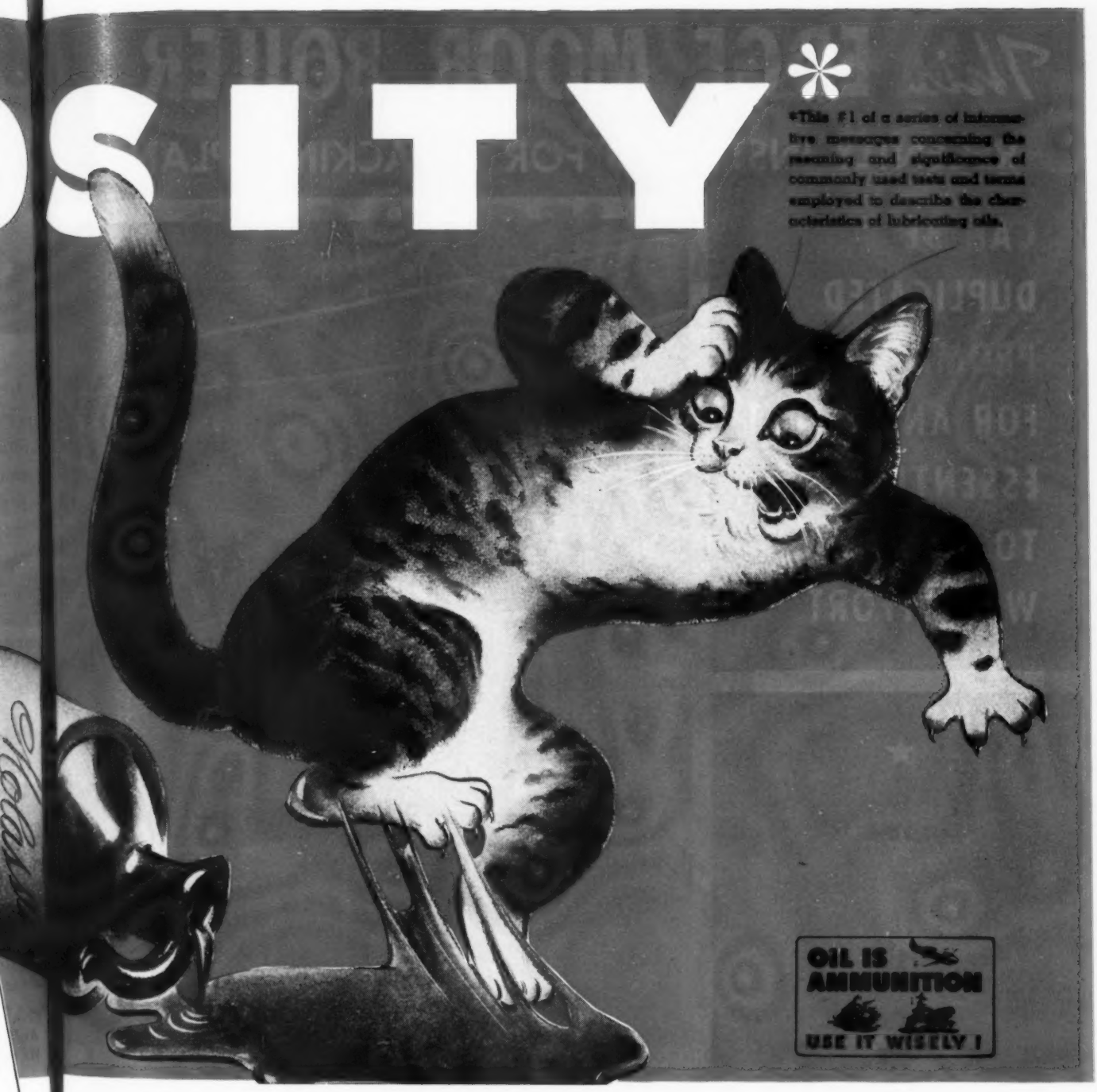
DRUMS! DRUMS! DRUMS!
War needs make it extremely important that all empty drums be returned immediately.

TYCOL

SCIENTIFICALLY

OSITY*

*This #1 of a series of informative messages concerning the meaning and significance of commonly used tests and terms employed to describe the characteristics of lubricating oils.



Tycol lubricants are manufactured to definite, predetermined viscosities. Each Tycol lubricant when used for the recommended purpose provides correct viscosity at the operating temperature. This accomplishes complete separation of the rubbing surfaces by a film of oil for their protection, yet without needless drag from excessive fluid friction. This is but one of many tests that assure unvarying high quality in Tycol lubricants.

TIDE WATER ASSOCIATED OIL COMPANY

Eastern Division: 17 Battery Place, New York • *Principal Branch Offices:* Boston, Philadelphia, Pittsburgh, Charlotte, N. C.

MAKERS OF THE FAMOUS VEEDOL MOTOR OIL

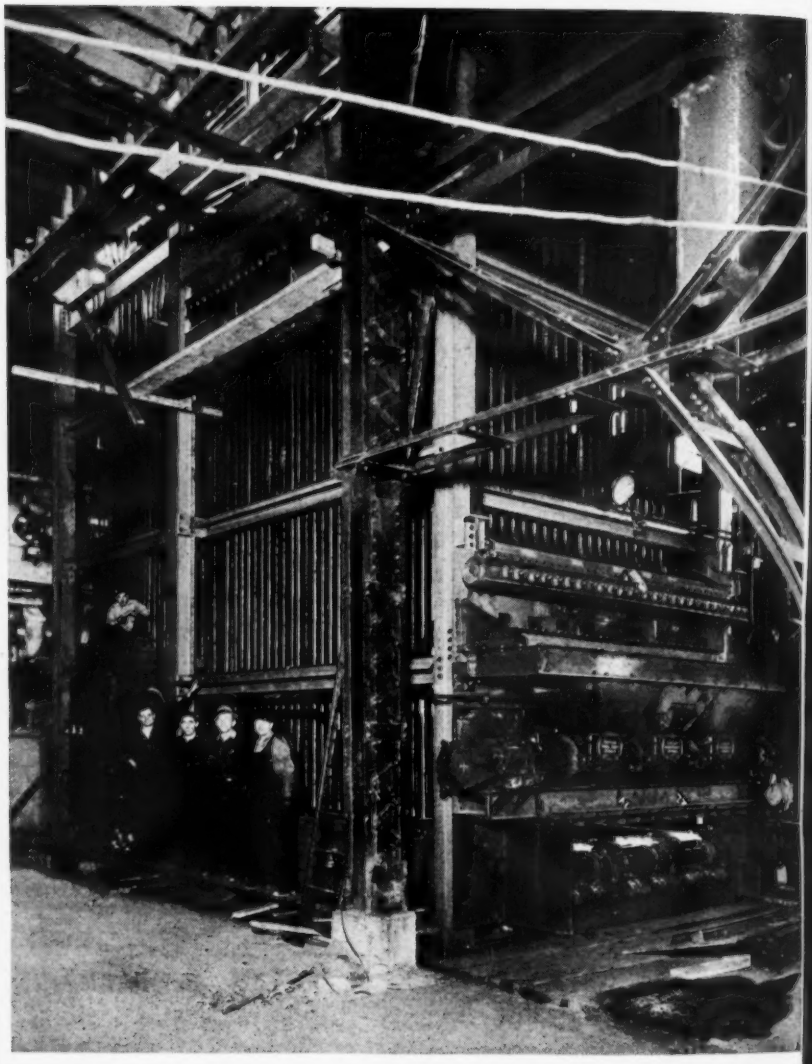
INDUSTRIAL LUBRICANTS

ENGINEERED FOR EVERY INDUSTRIAL USE

This EDGE MOOR BOILER...

RECENTLY INSTALLED FOR A PACKING PLANT

CAN BE DUPLICATED PROMPTLY FOR ANY PLANT ESSENTIAL TO THE WAR EFFORT



★
★
★

This 3-drum radiant heat, bent tube Edge Moor steam generator—shown here in process of erection—was recently installed in the plant of a prominent meat packing company.

Equipped with superheater, economizer, water walls and fired with a continuous ash discharge spreader stoker, this Edge Moor unit produces 60,000 lbs. steam per hour at 275 lbs. pressure and 500° F. steam temperature.

With all drawings available, Edge Moor can reproduce this unit promptly to original specifications.

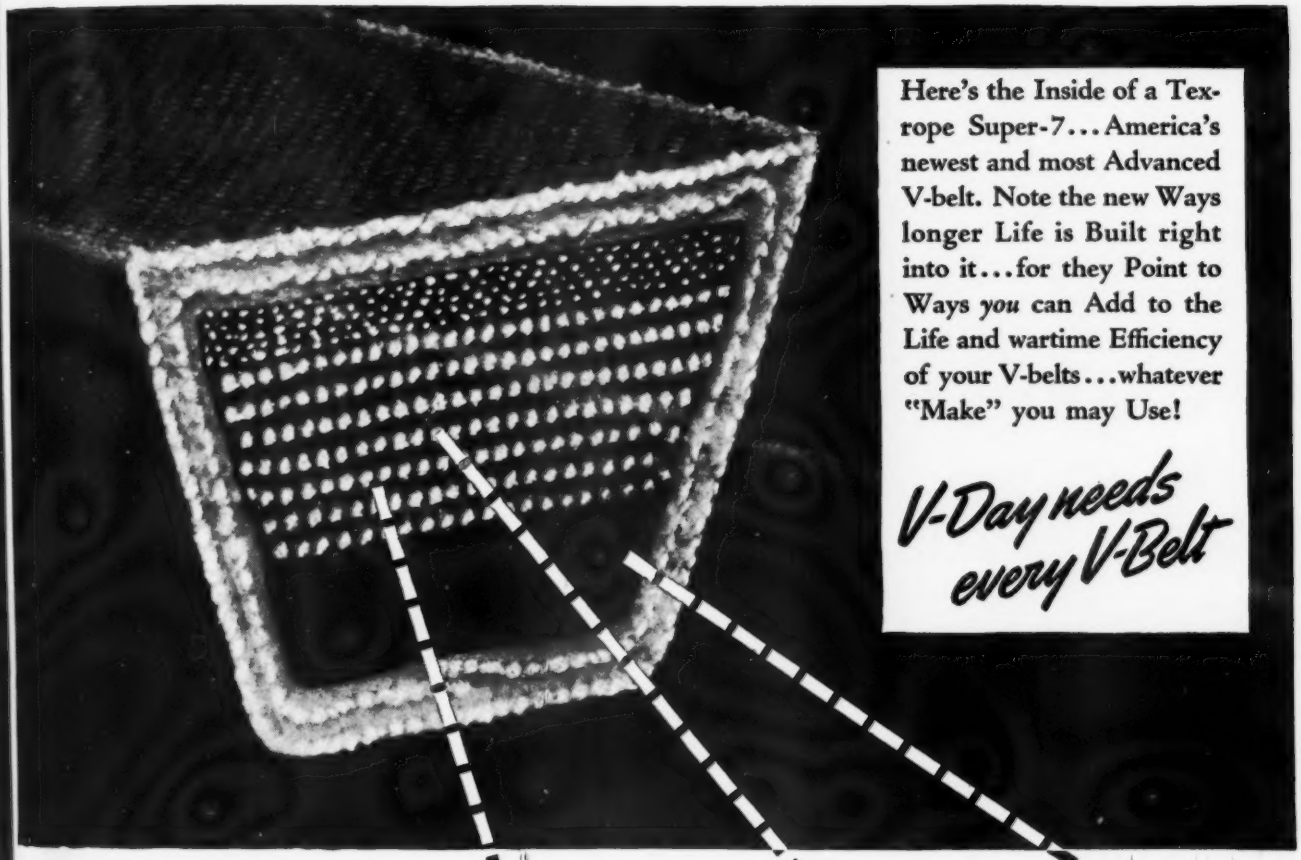
Edge Moor offers complete installation service including furnishing and erecting boilers, superheaters, water walls, economizers and air preheaters.

EDGE MOOR IRON WORKS, INC. 30 ROCKEFELLER PLAZA NEW YORK, N.Y.

KANSAS CITY CHICAGO DETROIT RICHMOND, VA.

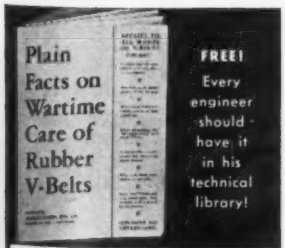
IN CANADA— UNITED STEEL CORPORATION, LTD. TORONTO, MONTREAL

X-Ray of IDEAS FOR Longer Wear



Here's the Inside of a Texrope Super-7... America's newest and most Advanced V-belt. Note the new Ways longer Life is Built right into it... for they Point to Ways *you* can Add to the Life and wartime Efficiency of your V-belts... whatever "Make" you may Use!

V-Day needs every V-Belt



It's packed with vital facts on care of *all* makes of V-belts — contains no advertising. Send in for it *today!*

50% STRONGER CORDS produced by the new Flexon process combat stretching. **You** can fight stretching—and the slip and heating that result—by promptly taking up any slack in your drives. Remember, V-belts working round the clock need inspection *4 times as often* as in peacetime!

20% MORE CORDS than before help protect the new Texrope Super-7 against strains and breaks. **You** can minimize breaks in your plant—whatever "make" of V-belts you use—by requiring that V-belts *never* be pried into grooves. Good rule for cutting down internal injuries!

NEW COOLER-RUNNING CUSHION of special rubber "eases" Texrope Super-7 cords around sheaves — for smoother flexing and less heat. **You** can fight heat by preventing misalignment. It causes rubbing of belt sides. So keep sheave grooves in line — shafts parallel.

☛ *When you do Need new V-belts, invest in the Best . . . Texrope Super-7!*

A 1544-A

ALLIS-CHALMERS

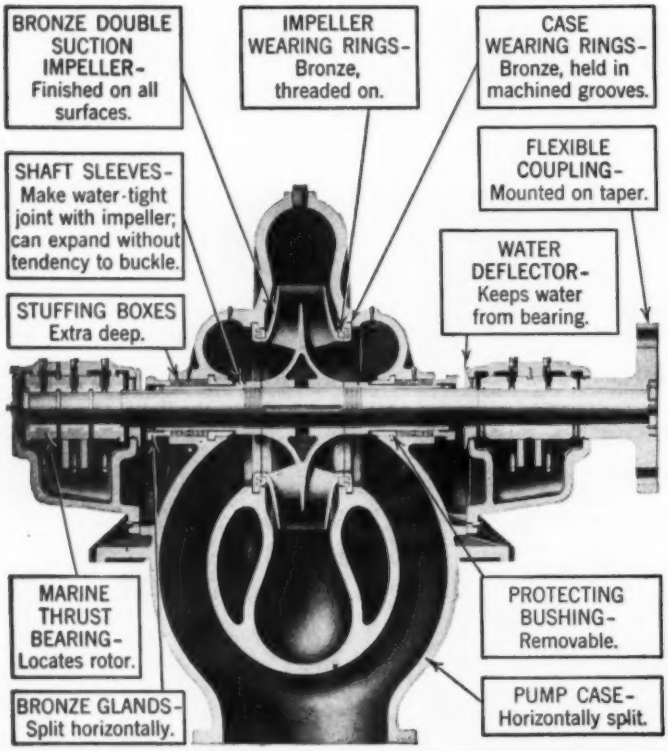
TEXROPE* SUPER-7 V-BELTS

WE WORK FOR VICTORY — WE PLAN FOR PEACE

*Trade mark registered U. S. Patent Office. Texrope Super-7 V-Belts are the result of the cooperative research and design genius of two great companies — Allis-Chalmers and B. F. Goodrich — and are sold exclusively by Allis-Chalmers. Available in all sizes..... ½ h.p. to 2,000 h.p.

SUSTAINED EFFICIENCY

OF DE LAVAL PUMPS

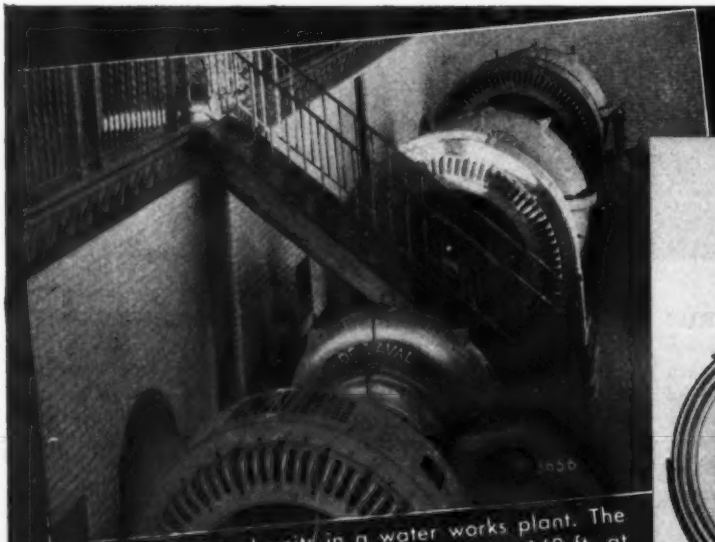

BRONZE DOUBLE SUCTION IMPELLER- Finished on all surfaces.
IMPELLER WEARING RINGS- Bronze, threaded on.
CASE WEARING RINGS- Bronze, held in machined grooves.
FLEXIBLE COUPLING- Mounted on taper.
SHAFT SLEEVES- Make water-tight joint with impeller; can expand without tendency to buckle.
WATER DEFLECTOR- Keeps water from bearing.
STUFFING BOXES Extra deep.
MARINE THRUST BEARING- Locates rotor.
PROTECTING BUSHING- Removable.
BRONZE GLANDS- Split horizontally.
PUMP CASE- Horizontally split.

is due to proper hydraulic design, which avoids cavitation and pitting, and particularly to renewable *LABYRINTH WEARING RINGS*, which protect casing and impeller from erosion and reduce leakage from discharge to suction.

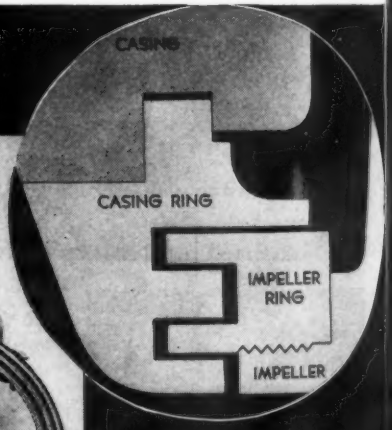
With De Laval *LABYRINTH RINGS* there is only about one-third as much leakage as between plain rings having the same radial clearance, or for the same initial efficiency De Laval pumps can have greater clearances than can pumps with flat rings. Because of the reduced leakage there is less erosion of De Laval rings than of flat rings and efficiency is better sustained. De Laval pumps which have been in continuous service for many years without renewal of parts still equal their original efficiencies, as demonstrated by numerous tests.

All parts of De Laval pumps are interchangeable on a limit gage basis and renewals ordered by number require no fitting.

State your pumping conditions and ask for Publication P-3222.



Three De Laval units in a water works plant. The largest, rated at 38,000 g.p.m. against 160 ft. at 600 r.p.m., showed on the acceptance test an overall efficiency, including motor, of 88.0 per cent.



Section through labyrinth wearing rings.

Labyrinth case protecting ring.

HYDRAULIC INSTITUTE U.S.A.

DE LAVAL

Steam Turbine Co.

TRENTON, N.J.

MANUFACTURERS OF TURBINES · STEAM, HYDRAULIC, PUMPS, CENTRIFUGAL, PROPELLER, ROTARY DISPLACEMENT, MOTOR-MOUNTED, MIXED-FLOW, CLOGLESS, SELF-PRIMING, CENTRIFUGAL BLOWERS and COMPRESSORS, GEARS, WORM, HELICAL and FLEXIBLE COUPLINGS

POWER

A McGRAW-HILL PUBLICATION

FEBRUARY, 1943 • VOLUME 87 NUMBER 2

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FUELS AND FIRING
STEAM GENERATORS
STEAM TURBINES AND ENGINES
STEAM-POWER AUXILIARIES
HYDROELECTRIC POWER
DIESEL AND GAS ENGINES
PUMPS AND COMPRESSORS
PIPING, VALVES AND FITTINGS
AIR CONDITIONING, REFRIGERATION
ELECTRICAL EQUIPMENT, ELEVATORS
INSTRUMENTS AND CONTROL
STEAM SERVICES AND HEATING
TRANSMISSION, LUBRICATION
OPERATION AND MAINTENANCE
POWER MISCELLANY

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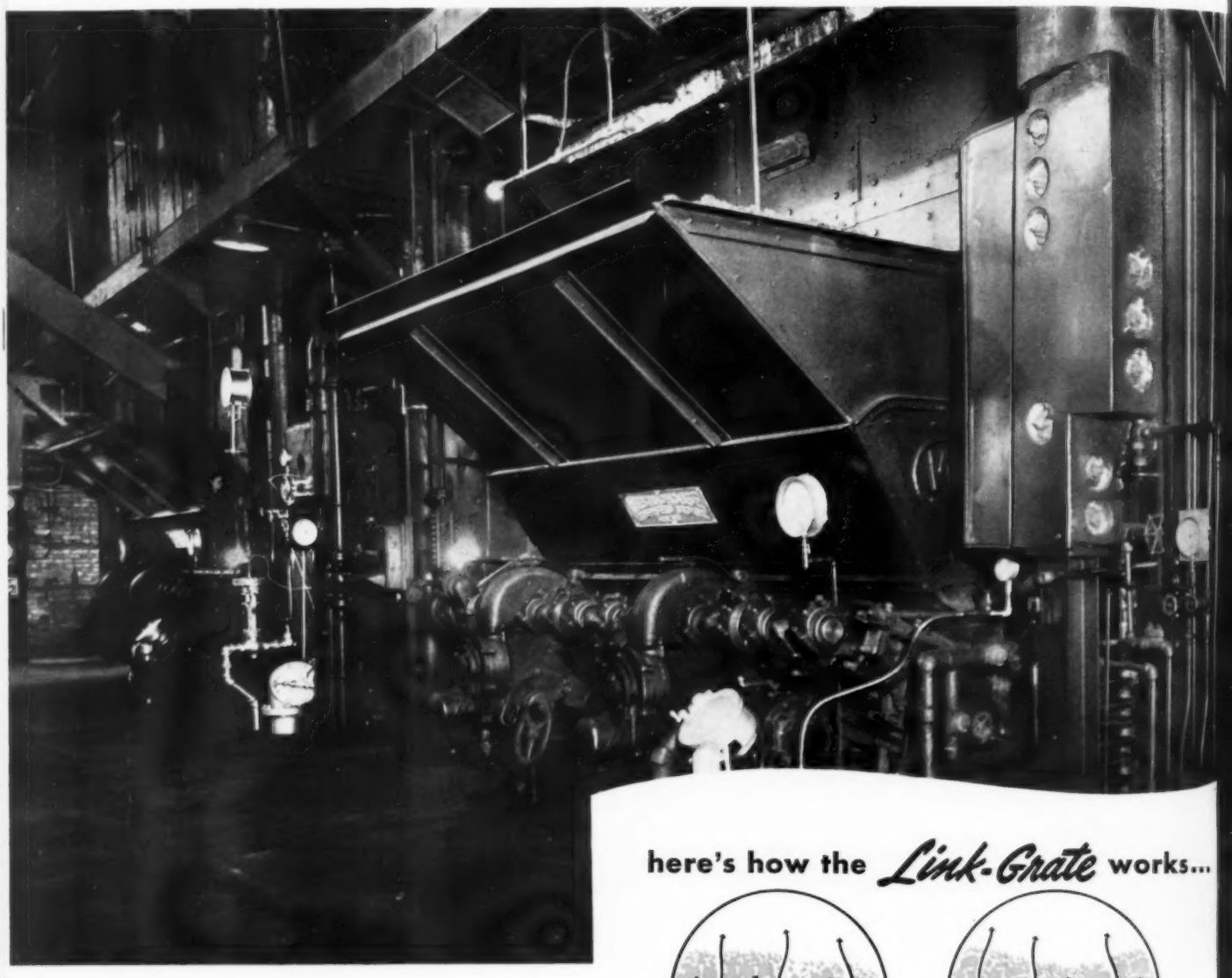
A *Link-Grate* STOKER



here's how the *Link-Grate* works...

GRATES UP

Fuel bed opened, thoroughly permeated with low-pressure air. Fused ash oxidized, clinkers broken into small, friable pieces.

GRATES DOWN

Fuel bed cracked, crumbled and made porous for uniform flow of gases throughout entire combustion zone.

will burn any coal you can get...

effectively

"This fact is important today, may become even more vitally important tomorrow ...Is it true of your present stokers?"

Low-grade Iowa coal is known as a tough fuel to handle, but Iowa Southern Utilities Company burns it regularly at this Ottumwa, Iowa, plant, with an efficiency of approximately 80%. Grate replacements are few, maintenance is low, and normal operating practice calls for continuous service periods of four months or longer for each of these Link-Grate type SDL stokers. This typical example backs up the statement that you can burn any grade of bituminous coal in a Link-Grate stoker—and burn it effectively.

LINK-GRATE MOTION is the secret of fuel flexibility. The fuel bed is kept porous. Continuous motion of the grates prevents formation of troublesome clinkers. An undulating, wavelike motion conveys the entire fuel bed steadily towards the ashpit, and ejects ash off the ash discharge plate at every cycle.

Link-Grate stokers are being used to burn efficiently all grades of bituminous coal—from low grade Iowa coal with 18% ash and 1930° to 2200° F. ash fusion temperature, to premium West Virginia coal with 6% ash and 2500° to 3000° F. ash fusion temperature. This versatility is your assurance of uninterrupted operation. It means long range fuel economy as well, because when free selection is again possible, you will be able to get the greatest amount of heat per dollar of investment in coal.

See Link-Grate stokers in operation, talk with operators and plant management, and get the performance figures. A Westinghouse representative will arrange a visit for you. J-50415

here's how you can get the complete story of low-cost steam

Fuel versatility is one of the many factors contributing to the proved low cost of steam from a Link-Grate stoker. Others include: high availability, low operating and maintenance costs, complete safety, ability to handle wide fluctuations in load. To get the complete story, write for Bulletin 3039 (multiple retort) or 2196-A (single retort). Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., Dept. 7-N.

WESTINGHOUSE

Westinghouse

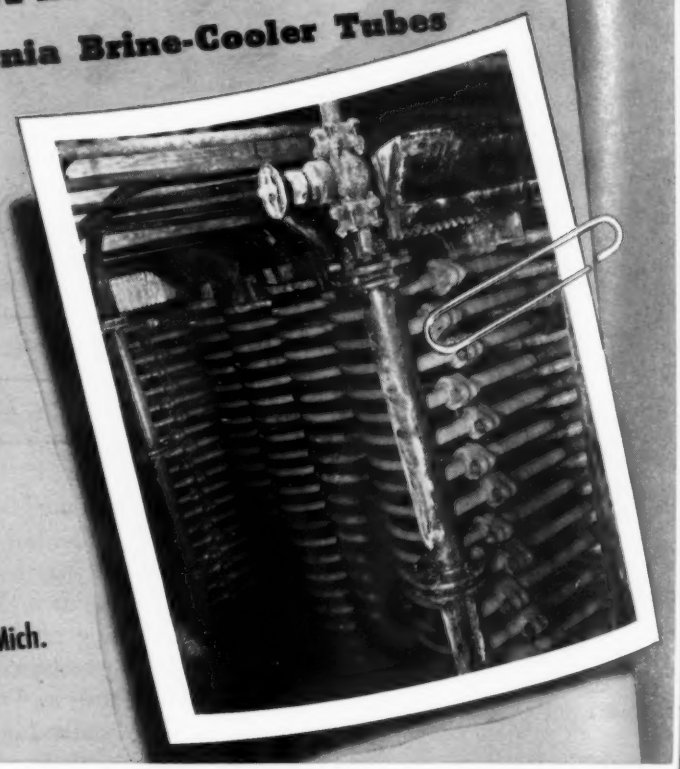
MEMO

Subject: BYERS WROUGHT IRON

for Ammonia Brine-Cooler Tubes

To: [*please route*]

- ☐ P. C. J.
- ☐ Wm. V.—Kitchener, Ont.
- ☐ Geo. H.—Menard, Ill.
- ☐ M. N. G.—Fairview, N. J.
- ☐ F. D. S.—Tampico, Mex.
- ☐ B. C.—Mount Vernon, N. Y.
- ☐ A. R. C.—Cleveland, O.
- ☐ K. M. H.—St. Louis, Mo.
- ☐ J. M. G.—Grand Rapids, Mich.
- ☐ C. B.—Schenectady, N. Y.



The Question

WE MUST RETUBE OUR AMMONIA BRINE *cooler with charcoal-iron tubes, as steel ones are not available. After receiving several recommendations on this material we have decided to go ahead with the retubing. However, I am still concerned about what effect the ammonia will have on these tubes and whether they will stand up as well as those made from steel.*

We use calcium-chloride brine. Ammonia suction pressure is 10-30 psi, and the brine temperature varies from 0 to 10 F. The cooler has 80 tubes 2 in. in diameter by 16 ft long.—PCJ

When you wrote this letter to POWER'S Question Box about Ammonia Brine-Cooler Tubes, P.C.J., you certainly started something. And the nine men (initials above) that answered did a bang-up job. Do you have any objection if we now put in *our* two-cents worth?

First let's be sure we're talking about the same thing. Some of the smartest engineers in the country sometimes use terms like "Wrought Iron," "Charcoal Iron" and "Knobbled Iron" interchangeably. This is misleading.

Charcoal Iron was the name for the original American Version of "Swedish Iron," made by charging pig in alternate layers with charcoal in a "Finery" furnace. When the pig contained too much impurity, it was first melted and partially refined in an open-hearth like furnace, tapped and allowed to solidify. It is later broken up and charged in the "Finery." Some slag was entrapped—but most was squeezed out in rolling.

Later, steel scrap instead of pig was charged into the "Finery." The resultant product was almost totally lacking in slag. While sometimes sold as "Charcoal Iron," it is more properly known as "Knobbled Iron" to distinguish it from that made by the two stage process.

Wrought Iron has a carbon content lower than Swedish Iron and about the same as Knobbled Iron. Its major difference is a slag content almost double the others. Further, this slag is predominantly silica. Authorities agree that the unusual corrosion resistance of wrought iron comes jointly from (1) the purity of the base metal, and (2) the nature and distribution of the slag fibres.

When it comes to the durability of wrought iron in cooler tube applications, we of course don't need to get technical. All that's necessary is to reach into the file, and pull out some of the hundreds of case histories that friendly engineers have reported to us. The picture shows a wrought iron ammonia condenser in a Rhode Island Plant, still in service after 44 years. And that's only one of many.

You'll find a number of them illustrated and described in our refrigeration bulletin. Or, if you prefer, our Engineering Service Department will write you some specific examples. Just let us know which.

A. M. Byers Company. Established 1864. Offices in Pittsburgh, Boston, New York, Philadelphia, Washington, Chicago, St. Louis, Houston, Seattle, San Francisco.

Corrosion costs you more than Wrought Iron

BYERS GENUINE WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

STEEL TUBULAR PRODUCTS

POWER

Established 1882 • PHILIP W SWAIN, Editor

"MANPOWER" will be industry's big worry right through 1943. So far power plants have been troubled less than manufacturing departments, but this can't last. Draft boards will have to get tough to expand America's armed forces from six million men to ten million in these twelve months.

Particularly will they be tough when the power-plant employee is young, healthy, and generally fit for a soldier's life. If the chief complains that taking this man would waste years of good mechanical training, the army may remind him that you can't run a modern mechanized division with a bunch of "butter fingers."

If it's certain, then, that power plants will lose "key" men in 1943, what's to be done about it? Some foresighted engineers found the answer years ago when staff flexibility was merely a matter of good peacetime management. To stimulate ambition, and prepare for run-of-mine personnel emergencies, they trained every teachable employee to do another power man's job—generally the job of the man ahead.

Today, under the lash of war shortages, that practice has become a national necessity and has even been given a name—*upgrading*.

One point needs stressing; this whole manpower problem is mainly a simple matter of *teaching*. The average chief knows his plant from stem to stern, and knows how to give sensible orders to trained assistants. But when it comes to breaking in a green hand or upgrading a long-time employee, he often falls short because he hasn't the sympathetic attitude of the good teacher or hasn't practiced the art of imparting useful information.

Here are some training tips: Ease the green man into a new situation a bit at a time, just as you would teach a baby to walk. Explanation is essential, but long-winded lecturing generally goes in one ear and out the other. Men learn best through their own eyes and fingers. Don't smother the natural urge to explore the plant. Stand ready to answer questions—even foolish questions. Encourage home study, with problems—and help the man to tie the book work to his plant job.

This war developed the self-sealing gasoline tank for warplanes. Perhaps, also, it will popularize the "self-sealing" power staff whose members are trained to upgrade themselves instantly to fill any emergency gap, until only the lowliest job in the department needs filling from the outside.

Throughout 1942, POWER has discussed the pros and cons of wartime manpower, notably in the September section "Power Teamwork for Victory". Now that the problem comes closer to home, the treatment will get down to brass tacks. As a starter, turn to page 66 for the story of the Merchant Marine's "sea projects", remarkable new training tool for seagoing engineers and a red-hot tip for those who must train power operators for land jobs.

HERE'S AN IDEA FOR LAND PLANTS

While America's shipyards have been beating their own world's records, education, too, has gone into high gear turning out engineer officers to handle the steam and diesel propulsion machinery of the new ships. Traditionally it takes at least four years to train an engineer officer, but War changed all that. Now only 16 months can be allowed to convert a smart young high-school graduate into an officer ready to stand watch at sea. The USMM Cadet Corps has met this challenge with a new and efficient tool for teaching on the job—at sea.

Because land plants, too, face a manpower shortage, and must learn to train men better and faster, the editor sought the secret of this new brand of seafaring education. That secret, as Commander Hochuli makes clear in this article, is the "Sea Project".

Any chief on land can copy this idea if he wishes—can draft questions to guide the new plant recruit in self instruction, using the plant itself as a textbook. Here's a way to solve manpower problems.—Editor.

Mr Telfair Knight, Director, Div of Training, War Shipping Administration

"SEA PROJECTS" SPEED TRAINING OF

TO UNDERSTAND the "Sea Projects"—new tool of practical education—one must first know something about the United States Merchant Marine Corps, its background, its purpose and the problems it faces.

The Corps was established in 1938 under the auspices of the United States Maritime Commission. Its original 4-year curriculum combined theoretical study at shore bases with practical seagoing training on regular vessels of the United States Merchant Marine. At that time the course of training at sea consisted of a series of extension or correspondence courses. Besides standing watch and performing their routine shipboard duties, "engine cadets" studied steam, diesel and electrical engineering. "Deck cadets" studied seamanship, cargo handling, ship construction, navigation, first aid, etc.

To help the cadet-midshipman in this academic work, two hours of ship's time was allowed for study, the remaining work being done on the cadet's own time. He forwarded his completed quizzes to the Educational Unit of the Corps for grading and recording, then got them back for his further reference. Annual examinations gave the Educational Unit a further check on the progress of all cadet-midshipmen.

These extension courses worked out well under the originally existing circumstances. There was ample time to complete the lessons and a parallel opportunity to move ahead along practical lines. Courses could be laid out progressively, each built on what the student had learned in previous required courses.

War Brings Problems

In 1939, when the start of the war in Europe gave new importance to the shipbuilding program of the U S Maritime Commission, it became obvious that the greatly expanded program would soon create a shortage of merchant officers. The study course was reduced from four years to three.

This shortening of the program did not present any serious problem as far as the curriculum was concerned. Life at sea was still normal. There was still time enough to complete all assignments, although the original leeway had largely disappeared.

In December 1941, the entrance of the United States into the war, and the consequent mushrooming of the shipbuilding program, created an acute shortage of present and potential merchant officers. As a result the course was shortened to 22 months, then again to 16 months as the need for men grew more acute.

Officers in 16 Months

In the present 16-month curriculum the cadet-midshipman spends his first ten weeks at a shore school, the next six months at sea on a regular merchant vessel and the last seven and one half months in specialized advanced training at the United States Merchant Marine Academy at Kings Point, N. Y.

As might be expected, the last two reductions in the training period, coupled with the necessary change from normal to wartime activity at sea, created some very serious problems, especially in the six seagoing months of the educational program.

In the first place, a national emergency existed. The United Nations needed ships and men to man them, and we had pledged our energies to meet that need. Regardless of any educational ideas that had been entertained in the past, the inescapable requirements of the United Nations called for a drastic revision of the program. It became the job of the United States Merchant Marine Cadet Corps to take young men, fresh from high school, and train them in sixteen months to be licensed officers, able to stand watch.

This meant emphasizing the practical aspects of duties of the merchant officer and the responsibilities that went with those duties. Thus the training program had to be designed to make the young man as useful as possible aboard his ship in a minimum of time.

In the second place, conditions at sea were dractically changed. Time off watch could no longer be counted on for study, much less so the two hours of ship's time formerly set aside for such pursuits. For the safety of the ship all hands had to be on call at all times. Moreover, ships were required to run under blackout conditions at night. Living quarters were crowded to provide space for armed-guard crews. Ports of call were made in the shortest possible time to insure the maximum possible number of trips.

Capt R R McNulty, USNR, Asst Director Division of Training, WSA and Supervisor United States Marine Cadet Corps

Contributors and collaborators on THE SEA PROJECT. L to r; Lieut Comdr Althouse, USMS; Lieut Comdr McCready, USMS; Lieut Gald, USNR; Lieut McKenzie, USNR; Lieut Comdr Hochuli, USNR; Lieut Marshall, USNR; Lieut (jg) Elonka, USNR

MARINE ENGINEER OFFICERS

By LT COMDR E S HOCHULI, USNR, *Asst Sup. U S Merchant Marine Cadet Corps in Charge of Educational Unit*

Every one of these factors directly affected the use of academic extension courses for sea-training purposes. The problem, then, was to design an educational program that a cadet-midshipman could pursue at sea without the benefit of a regular instructor and under conditions adverse to study—a program that would teach him the fundamentals of his future job as an officer in the United States Merchant Marine.

Sea Projects the Answer

The answer to this problem was the Sea Project. Basically it is a program that uses the ship as a laboratory. Around this laboratory it weaves a series of practical assignments for the cadet to complete in his spare time. Even in working hours he will be gathering information for these projects if he keeps his eyes and ears open.

The Project is designed to acquaint the cadet-midshipman with every piece of equipment in his department aboard the ship and then guide him in a practical study of this equipment and its use. It is further designed to acquaint him with the duties of every officer and man aboard ship. In particular, it requires him to study in detail the duties of the Third Officer and the Third Engineer, since one of these would be the first position he would enter after graduation. It is finally designed to give the cadet a sound and practical preparation for his 30-week advanced course at the United States Merchant Marine.

The merit of this training method lies in the fact that it gives a maximum amount of education in (1) the shortest period of time, (2) without an instructor and (3) along as practical and useful lines as possible.

Laid out for completion over a period of six months, the actual Project is divided into twelve 2-week assignments. The questions are designed to instill resourcefulness, initiative, keen observation and the ability to do hard work.

This Project is long enough to force the cadet to plan his schedule if he expects to complete his assignments without interfering with his regular shipboard duties. Incidentally, the assumption of such responsibilities tests the cadet's ability to progress to the responsibilities of a ship's officer.

The assignments are bound in an Accopress loose-leaf binder. In it the cadet must bind all work performed, whether written on the assignment sheets themselves or written or drawn on separate sheets. When the Project is finished he has a compact and complete book that will serve him for years.

All Assignments Practical

The project work starts right at the beginning; the very first assignment gets the cadet-midshipman oriented on his ship. He learns his duties with respect to all shipboard drills—fire, boat, emergency, abandon ship, etc. The assignment directs him to inspect all safety equipment on board and finally takes him to those parts of the ship where his future duties will lie—the engine room, shop, engineer lockers, etc, in the case of the engine cadet.

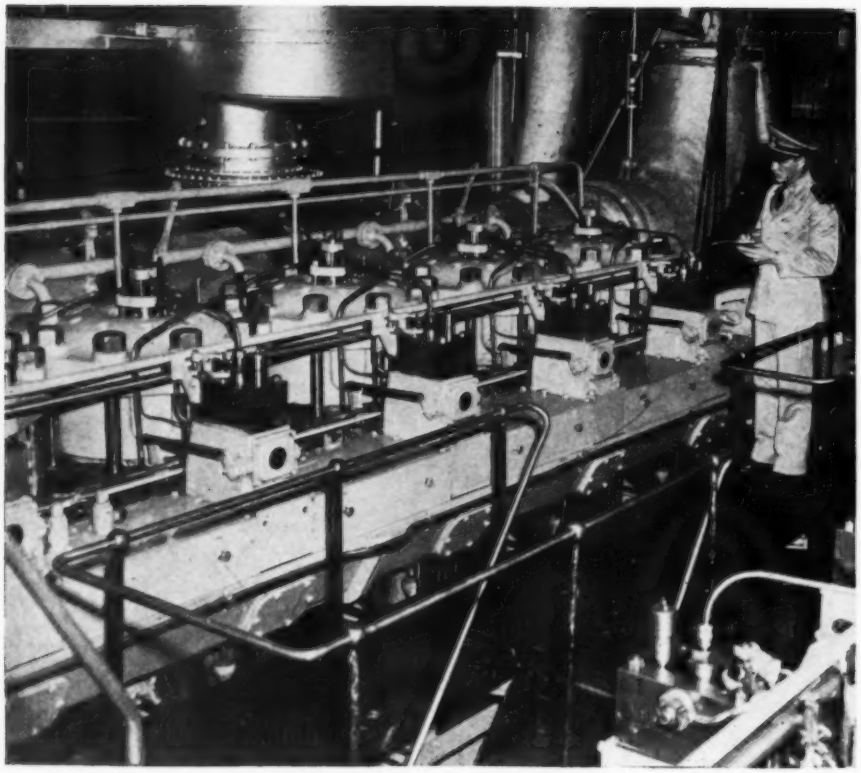
Part 2 of this first assignment closes with a detailed engine-room vocabulary listing over 280 names and terms used in everyday work and conversation among the engineers. The cadet is expected to become familiar with these terms and their exact meaning.

The second step (Assignment 2) guides him in an inspection of the engine room by requiring written descriptions of each item of equipment. Such information cannot be lifted from textbooks because the cadet is required to copy data directly from the nameplates of his own particular units and to answer questions about their specific peculiarities. Thus he is forced to crawl around the machinery, trace actual pipelines, ask questions of the engineers, and in general apply sweat and ingenuity to complete his assignment.

Next the cadet-midshipman, if assigned to a steam vessel, is led by Project instructions through an inspection of the fireroom, where he is required to accumulate and write down all necessary information about the boilers and related equipment.

Later assignments, on both steam and diesel vessels, guide him through a study of the different systems aboard his ship—the fresh-water system, fire system, bilge, fuel-oil, lubricating oil.

Following complete inspection of the machinery spaces, the assignment turns to a detailed description of the use of each system. The cadet must understand how each piece of equipment fits into the job of running and safeguarding the ship. He makes sketches, solves



Six months aboard a diesel ship is this cadet midshipman's assignment. Here he's gathering data about his own engine to answer the questions in his Sea Project

problems and prepares written descriptions of the various pieces of equipment and their use.

Here again the problems and questions always pertain to the equipment on the cadet's own particular ship. He can't dig ready-made answers out of a textbook. He has to crawl around the ship, use his eyes and his ingenuity. Winding up the Project is a detailed study of the duties of the ship's engineer officers with respect to the equipment and systems previously studied.

The Sea Project for steam vessels is a fairly hefty volume—about 250 large mimeographed sheets. That for diesel ships runs about the same size. The random excerpts at the bottom of pages 68, 69 give some idea of the contents.

Method Would Work on Land

These Sea Projects represent a practical answer to a pressing wartime problem of the Merchant Marine. Because the general idea is sound, it should find wartime and peacetime applications in other fields.

Such a system of training should be applicable in all cases where the students are inexperienced, where time is at a premium, where instructors

RANDOM SAMPLES OF

The Sea Project for steam ships covers about 250 large mimeographed pages—same for diesel ships. These excerpts indicate the general character of the material. Note the sound pedagogy—these are not so much books of engineering information as road maps for young men who must go out and dig up their own answers.

In his 6-month stint at sea on a steam vessel, the cadet completes these twelve assignments, 24 parts in all.

Assignment I
Part I Emergency Rules. Equipment
Part II Study of Engineering Terms

Assignment II
Part I Inspection of Engine Room
Part II Inspection of Engine Room

Assignment III
Part I Inspection of Fire Room
Part II Inspection of Refrigeration Room

Assignment IV
Part I Inspection of Shaft Alley
Part II Steering Engine

Assignment V
Part I Tankage
Part II Deck Machinery

Assignment VI
Part I Machine Shop
Part II Fire-fighting and Safety Apparatus

Assignment VII
Part I Firetube Boilers
Part II Watertube Boilers

Assignment VIII
Part I Combustion and Combustion-Control Equipment
Part II Reciprocating Steam Engines

Assignment IX
Part I Steam Turbines
Part II Turbine Reduction Gears and Lubrication System

Assignment X
Part I Condensing Equipment
Part II Evaporators, Distillers, Steam Traps and Control Equipment

Assignment XI
Part I Pumps
Part II Electric Dynamos, Motors and Systems

Assignment XII
Part I Marine Power-Plant Maintenance
Part II Starting, Operating and Securing Marine Machinery

If you are a cadet, the first week aboard you learn your way around. Then you must check yourself to "make sure you have":

1. Learned your stations as to their locations and your duties at each one, *letter perfect*. Know the alarm given for each one.

2. Learned where each and every emergency escape from engine-room and living spaces is located. You should know how to find each one quickly even in complete darkness.

3. Learned where the emergency controls to the main engines, fuel pumps, and other important engine-room pumps are located, how they work, and when to use them.

4. Learned where all life-saving aids are located, and how they are used.

5. Learned the rudiments of your duties aboard ship as directed by the chief engineer.

6. Learned the part you must play in keeping your vessel blacked out each night.

Write down at least one question not included in this assignment with which you had trouble. Answer the question if possible.

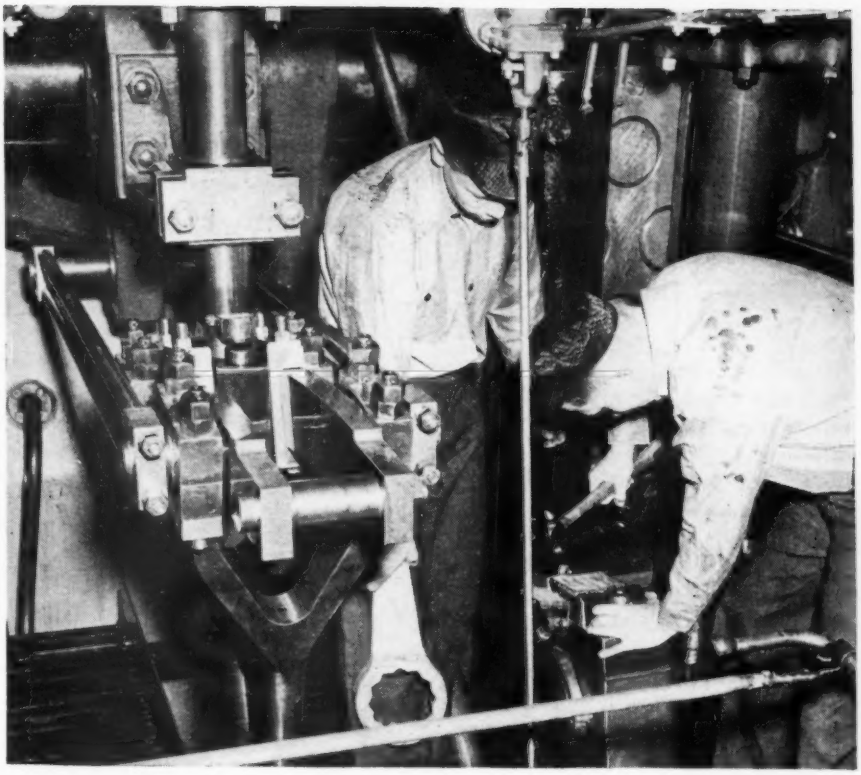
"Engine Room Inspection", a typical assignment, runs 11 pages and covers electric-generating system, fire pump, lube-oil pumps, fresh-water systems, bilge system, gages and thermometers, circulating pumps, condensate pump and air pump, plus 35 questions and 5 sketches. Here are sample questions:

are not available, and where a good sound practical knowledge of a particular type of equipment is required. Specifically, something of this sort could be used for the quick training of operators in land power plants.

A training program of this type should be built around the particular plant in which the student is working, so that his powers of observation, and his familiarity with the equipment he will actually handle are stressed above all other considerations.

Today the efficient utilization of our available manpower is not only a serious problem, but a responsibility of citizenship. It is not fantasy to foresee the time when every man of experience must become a teacher if the available men are to be trained to do the jobs that must be done to win this war.

How well those jobs are done will depend on how quickly each man is trained. And how quickly he is trained depends on the efficiency of the teaching method used. Industry may soon be required to go deeper into the problem of "training its own" and this outline of the Sea Projects is offered to the readers of POWER as a helpful suggestion to that end.



Two cadet midshipmen key up a crosshead—an actual shipboard operation. When it's finished they will enter a detailed report in their Sea Project binders

THE SEA PROJECTS

1. Do the dynamo sets on your vessel take steam at boiler pressure or at reduced pressure?
2. Is the dynamo on your ship driven by a steam turbine or by an engine?
3. What voltage does the dynamo set customarily generate for the ship's lighting circuits? Is this alternating or direct current?
4. Does the dynamo engine have to be speeded up or slowed down if the demand for electricity varies, or does it govern itself automatically to keep at a steady speed regardless of variations in load on the electrical circuits?
5. About how many days does one dynamo set run on your ship before the other dynamo is started up to take over the duty?

Cadet must crawl around until he can answer 35 questions on watertube boilers, including these:

5. Why are stays not required in a watertube boiler even though the pressure carried is higher than in a Scotch boiler?
6. What valve or valves are usually connected to the dry pipe?
7. Where are the water test cocks located on a watertube boiler?
8. Why is it necessary to water-turbine or air-turbine boiler tubes?
9. Explain how you would raise steam on a cold watertube boiler?
10. Why must the fires be cut out on a watertube boiler, while giving it a bottom blow?

And here are sample turbine questions:

19. List the wearing surfaces on main turbine, steam end.
20. What are the usual bearing clearances on a turbine?
21. What would happen if the lubricating oil to the turbine failed, assuming that the turbine did not stop?
22. What might happen to the turbine blades if water was carried over from the boilers with the steam?
23. What precautions and details of construction prevent water from entering high-pressure turbines?
24. What do you understand by superheated steam?

He makes these sketches of cooling system to make sure that he understands their construction and operation:

1. Make diagrammatic line drawings showing the main-engine cooling-water circulation system on your ship. Show all valves, thermometers and pressure gages. These drawings should be placed in your note book immediately after this page.
2. Make a diagrammatic line drawing showing the main-generator engine cooling-water system. Show all valves, thermometers and pressure gages. This, too, should be placed in your note book in proper order.
3. Sketch a cross-sectional view of the sea suction strainers on your ship.

One very practical assignment is to study the diesel fuel-oil system of his ship, then answer 25 questions and make 2 sketches, including:

23. If the fuel oil to the main engine were contaminated with water, explain the effect upon the engine.
24. In case you had to stop the main engine because of the fuel oil being contaminated with water, explain at least two ways of drawing the water from the fuel system aboard your ship.
25. Explain why it is necessary to heat fuel oil supplied to boilers and why it is not necessary to do so for diesel-engines.

Sketches:

1. Make a diagrammatic line drawing showing the path of the fuel oil from the fuel-oil manifolds to the engine cylinders, showing all necessary equipment.
2. Make a cross-sectional view of one of the fuel-oil purifiers. Write down at least one question, not asked in this assignment, with which you had trouble. Answer the question(s) if possible.

How Evaporator Hookup Affects Heat Rate

Analysis of evaporator arrangements for a typical condensing plant indicates how heat rate is affected by use of single- or double-effect, evaporator condensers, location of evaporator system and amount of makeup

By M G J BOISSEVAIN* and ASCHER H SHAPIRO**

▶ To DETERMINE THE EFFECT of evaporator arrangement on heat rate of condensing power plants, calculations have been made to establish the Btu per kwhr for (1) single- and double-effect systems with and without evaporator condensers, (2) evaporator arrangements at higher and lower pressures in the bleed cycle and, (3) varying amounts of makeup.

The six basic hookups studied are shown diagrammatically in Fig. 1. Of these, for any given pair of bleed points between which the evaporator system operates, scheme 5 has the lowest plant heat rate. Next in order of increasing heat rate are schemes 4, 2, 6, 3, and 1. Results are graphically represented in Fig. 3.

Although calculations were made for a single set of steam conditions only, and although a number of simplifications and assumptions were made, the comparisons are valid for many different operating conditions since the basic cycle is the same for all evaporator arrangements. In this study turbine throttle conditions were taken as 850 psi gage and 900 F with 1.4-in. Hg condenser pressure. These conditions are typical of some recent installations.

Table I—Turbine Data For All Schemes

Bleed Point	Pressure, Psi Abs	Temperature, F	Enthalpy, Btu Per lb.
Throttle	864.7	900.0	1453.1
First	173.0	590.1	1319.0
Second	97.0	475.4	1267.0
Third	35.2	304.0	1190.0
Third*	26.8	259.7	1170.0
Fourth	7.52	180.1	1093.0
Condenser	0.688	89.5	982.2**

*All schemes marked with asterisk differ from others only in the conditions at third bleed point.

** Includes leaving kinetic energy.

The basic cycle for all plants has four turbine extraction points, the pressures and temperatures of which are given in Table I. The effect of changing the third bleed point to a lower-pressure stage of the turbine has been studied for the several cases marked with an asterisk in Fig. 3. Except for the lower-pressure third bleed point, these cases are identical with the others shown.

It is assumed throughout that the equipment is designed to satisfy the thermal requirements. For instance, when the makeup varies, the size of the evaporator is assumed to be adjusted to accommodate the change in makeup

* Stone & Webster Engineering Corp.
** Department of Mechanical Engineering, Massachusetts Institute of Technology.

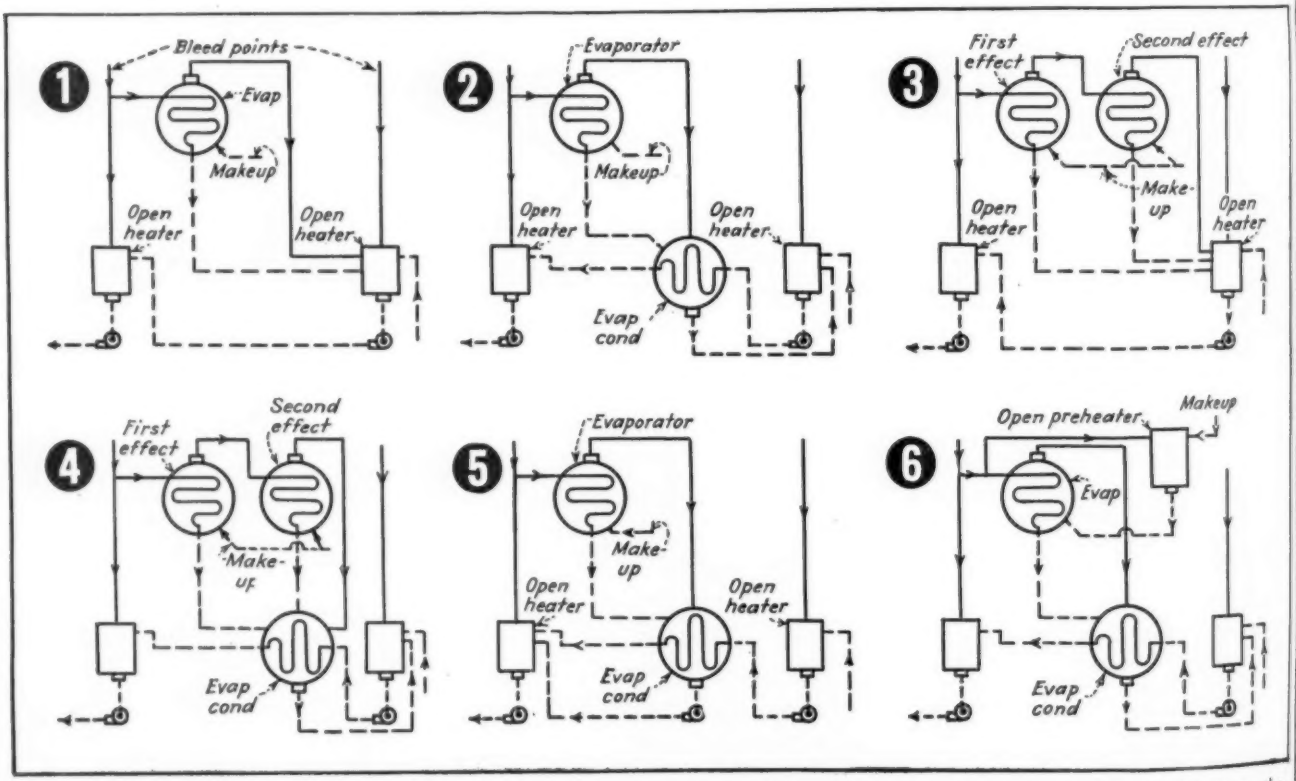


Fig. 1—Six basic evaporator arrangements. In each case evaporator steam comes from the higher of two bleed points and the evaporated makeup goes to an evaporator condenser or the next lower pressure heater in the condensate cycle

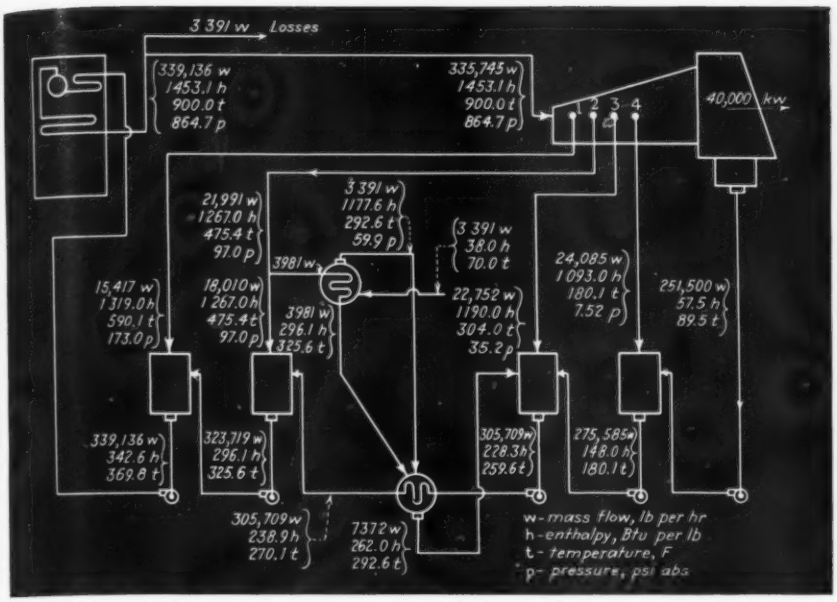


Fig. 2—Heat-balance diagram for a 4-stage extraction cycle with a single-effect evaporator and evaporator condenser operating with 1% makeup at 40,000-kw. load

rate and the design of the turbine modified to retain the same condition curve. Other assumptions that simplify calculations include: (1) all heaters are open, (2) pressure drops in piping, heaters, evaporator, and evaporator condenser are neglected, (3) boiler blowdown, gland losses and steam used by air ejectors are neglected, (4) heat losses, changes in elevation and changes in kinetic energy are neglected except that the leaving loss of the turbine is taken into account, (5) enthalpy increase of the condensate in air ejector condensers, oil coolers air or hydrogen cooler and pumps is neglected, (6) condensate leaving open heaters, drip from evaporator coils and drip from evaporator condenser are saturated, (7) evaporated vapor is saturated, (8) all steam lost from the system leaves at 850 psi gage and 900 F and all makeup enters at 70 F, (9) the sum of bearing and generator losses is 800 kw at 40,000-kw generator output, and (10) for schemes 2, 5 and 6, the temperature drop available between the two bleed points is assumed to be equally divided between evaporator and evaporator condenser.

When the evaporators are shut down (makeup zero) the heat rate of all schemes except those indicated by an asterisk is 9302.5. The asterisk cases (an assumed lower-pressure third bleed point) have a zero makeup heat rate of 9301.3.

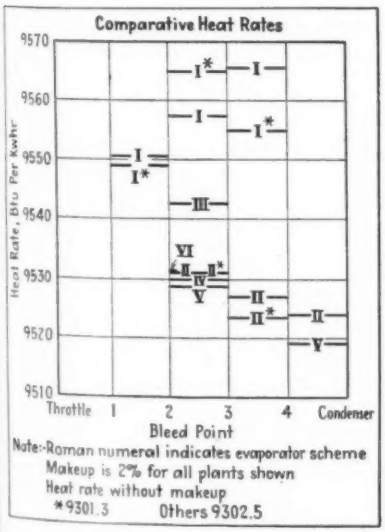


Fig. 3—Graphical comparison of heat rates. Roman numerals correspond to evaporator schemes of Fig. 1, and vertical lines indicate the bleed points between which the system operates. All plants shown in this chart operate with 2% makeup based on total steam generated by the boiler

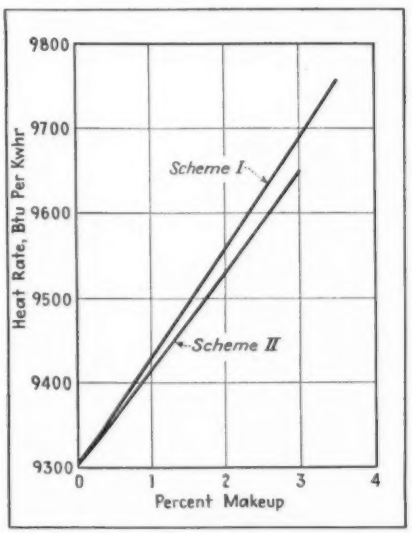


Fig. 4—Dependence of heat rate on percent makeup for schemes 1 and 2 operating between second and third points

The six basic schemes of Fig. 1 can be compared by observing their heat rates when each is connected between the same pair of bleed points. Inspection of Fig. 3 shows quantitatively the relative efficiency of each scheme operating between second and third bleed points. The effect on all schemes of lowering third bleed point pressure can be noted qualitatively and quantitatively by comparing the plants with and without asterisks. The heat rate of scheme 2 is slightly improved if the third bleed pressure is reduced, while the effect on the heat rate of scheme 1 depends on the pair of bleed points between which the evaporator is operating.

A separate set of computations, the results of which are not included here, indicates that the heat rate can be changed a maximum of two Btu per hr by varying the vapor temperature from the evaporator in scheme 2, the lower value being attained with the smallest practical temperature drop across the evaporator condenser. From this it can be concluded that the chief object in choosing the temperature of the evaporated makeup for scheme 2 should be the attainment of reasonable temperature differences for both the evaporator and its condenser.

Schemes 2 and 5 have lower heat rates if the evaporator system is placed between low-pressure bleed points than if located between high-pressure bleed points. Scheme 1 shows an opposite trend for the actual turbine bleed pressures but, if operation between third and fourth bleed points is desirable, scheme 1 is improved by lowering the third-bleed-point pressure. The heat rate of scheme 2, on the other hand, is changed only slightly by lowering third-bleed-point pressure.

To sum up, it may be concluded that (1) the double-effect evaporator of scheme 3 is inferior to the single-effect evaporator with evaporator condenser of scheme 2, (2) the heat rates of schemes 4 and 5 are so little better than that of scheme 2 that it seems doubtful if the additional equipment cost is justified, and (3) it is preferable to use the single-effect evaporator, condenser and booster pump of scheme 5 than the double-effect system of scheme 4.

From the calculated results for the given condition, it is possible to arrive at an economical design for other installations without actually computing the heat rate for each possible arrangement. Keeping in mind the order of magnitude of the fuel savings involved and comparing them with relative fixed charges, one can closely approximate conditions of minimum total cost.

Overloads Are In Prospect

If generators must be run at higher than rated load, operators should check safety margin to avoid too great shortening of insulation life. J W Batchelor, generator engineer for Westinghouse, outlines some needed precautions

► EVEN WITH RECORD INSTALLATIONS of new turbine-generator capacity scheduled for 1943, new units can not be expected to carry ever-expanding war production loads. Obviously, present units must be operated in such a manner as to get most possible kilowatts by taking advantage of any margin in their generators consistent with safety.

Original test data often are inadequate for predicting maximum load that can be carried without exceeding standard limits for insulation. It is to the advantage of an operator to make his own tests while his machines are operating under load. Knowing the history of the machine, he can establish working limits of maximum load, taking into account the peculiarities of both machines and load curves.

Because of the many ways in which generator life can be shortened, the primary factor in overloading is temperature. An operator must consider the effect of temperature rise as well as total temperature. While the deteriorating effect on insulation of high temperatures is well known and that generator life can thus be shortened is obvious, it is not possible to predict accurately insulation life as a function of temperature. Some reduction in machine life, however, is certain if loads, and consequently temperatures, are increased.

On modern machines, practically uniform temperature is obtained throughout the length of rotor and stator coils by adequate ventilation. There is, therefore, less likelihood of breakdown on the newer units. Present standard temperature limits are sufficiently conservative, and it is to be expected that they can be exceeded somewhat. However, an unmeasureable but definite reduction in life must be weighed against the need for greater capacity.

Coil Expansion

If total temperature were the only criterion, the generator could be operated at loads well above normal maximum by lowering the ambient temperature. Temperature rise, however, places stricter limits on load. Copper coils have an expansion coefficient of 17 millionths of an inch per inch per deg Centigrade as compared to only 11 millionths for generator steel. Under increasing load, coils move in relation to the steel with which they are in contact and abrasion of insulation results. In machines of short coil length the relative movement is not large but in a coil length of 100 in., for instance, a 60-deg C rise of the coil temperature and a 40-deg C rise of the core will cause movement as great as 0.03 inch.

In the rotor, centrifugal force adds to the problem. If a rotor is brought up to speed before excitation is applied, coil and forging are at the same temperature. As the coil heats up when field current is applied, centrifugal force holds the coils tightly against wedges and retaining rings and expansion does not occur freely over the full length of the rotor. Coil copper is deformed near the center of the rotor because the compressive force is insufficient to overcome friction.

When the generator comes off the line, the rotor stops soon after excitation is removed. There are no centrifugal forces present as the rotor cools and the coils contract to a shorter length. In this manner coils shrink over a period of time and, since the forces are unequal for several conductors in one slot, the various turns shrink a different amount, causing the ends to overlap. A general deterioration of the insulation results with the possibility of a short between end turns. In more modern machines, hard-drawn copper coils are used that have a sufficiently

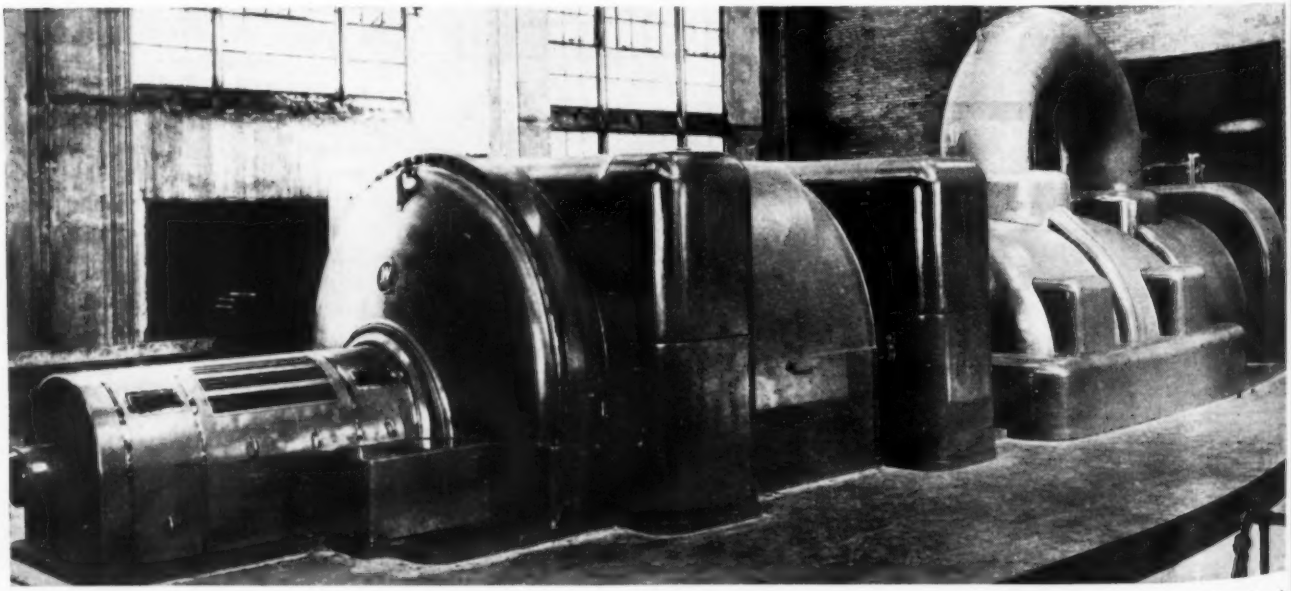


Fig. 1—A 15% increase in load can be had from this hydrogen-cooled generator by increasing hydrogen pressure from 0.5 to 15 psi

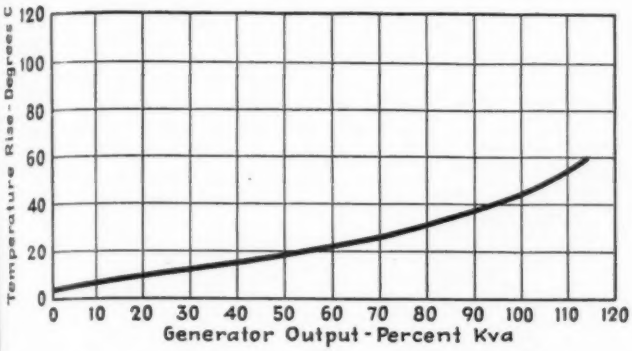


Fig. 2—In testing for temperature rise, plot stator winding temperature against kva generator output. Note steeper slope near full load; this indicates more rapid rise at overloads

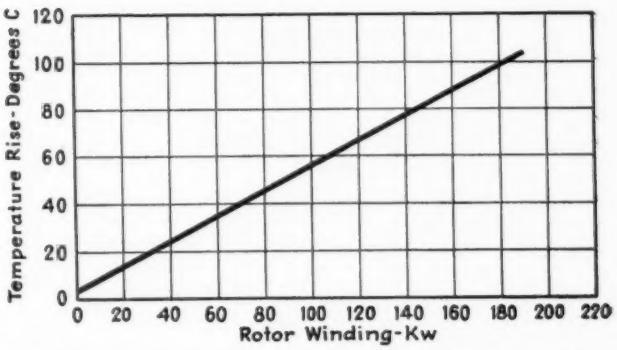


Fig. 3—Rotor temperature rise plots as straight line against excitation kw. Winding temperature is best determined by measuring resistance across sliprings

high yield point to resist permanent deformation under normal temperature cycles.

From the foregoing it can be seen that, if the temperature within a generator can be maintained at constant values for long periods, the deteriorating effect will be less severe than if the load varies frequently.

Watch Old Timers

Many older machines have stator core laminations of poor-quality steel and inadequate ventilating systems for disposition of losses in the area close to the air gap. Best materials and construction at the time of their building do not equal those developed since. Such generators operate satisfactorily at normal loads but are generally not suitable for much overload. For old machines extreme care should be taken in determining the temperature of all parts if operation at overload is contemplated.

Other old generators are subject to high temperatures on end and finger plates because of excessive leakage flux at the ends of the generator. Increased load means more leakage flux and even higher temperature. Most generators now in service are not subject to this trouble but the condition should not be disregarded in the few cases where it applies.

Internal cleanliness of the generator aids dissipation of heat losses. Particular attention should be given to the field winding because dirt is more apt to deposit on irregular surfaces. Inspection should be made to determine if dirt has accumulated in the ventilating passages of the stator core.

Constant Air Temperature

If the generator air circuit does not recirculate, air of nearly constant temperature should be supplied to avoid detrimental effects of temperature variation. For recirculating systems, the cooler should be inspected regularly to assure maximum heat transfer. Generator temperatures depend on temperature of ingoing air.

An increase in load decreases short-circuit ratio. Ordinarily this is not serious, as increase in load is limited by temperature to a lower value than would affect the stability of an electrical system. However, no general rule can be set down and each case should be considered separately.

Auxiliaries Limit

Limitations on load may be imposed by auxiliary equipment such as exciters or rheostats. In some cases this can be remedied by transferring reactive kva to other units of the same system. However, if the exciter is known to have little margin of capacity, it should be checked by test.

Practically all hydrogen-cooled generators deliver rated capacity with 0.5 psi hydrogen pressure but can be loaded up to 15% above normal by raising gas pressure to 15 psi. Increased load is practically a direct function of gas pressure. Newer machines require no new equipment for operation at the higher gas pressure; older units require relatively inexpensive changes in terms of either material or labor as compared to new unit capacity.

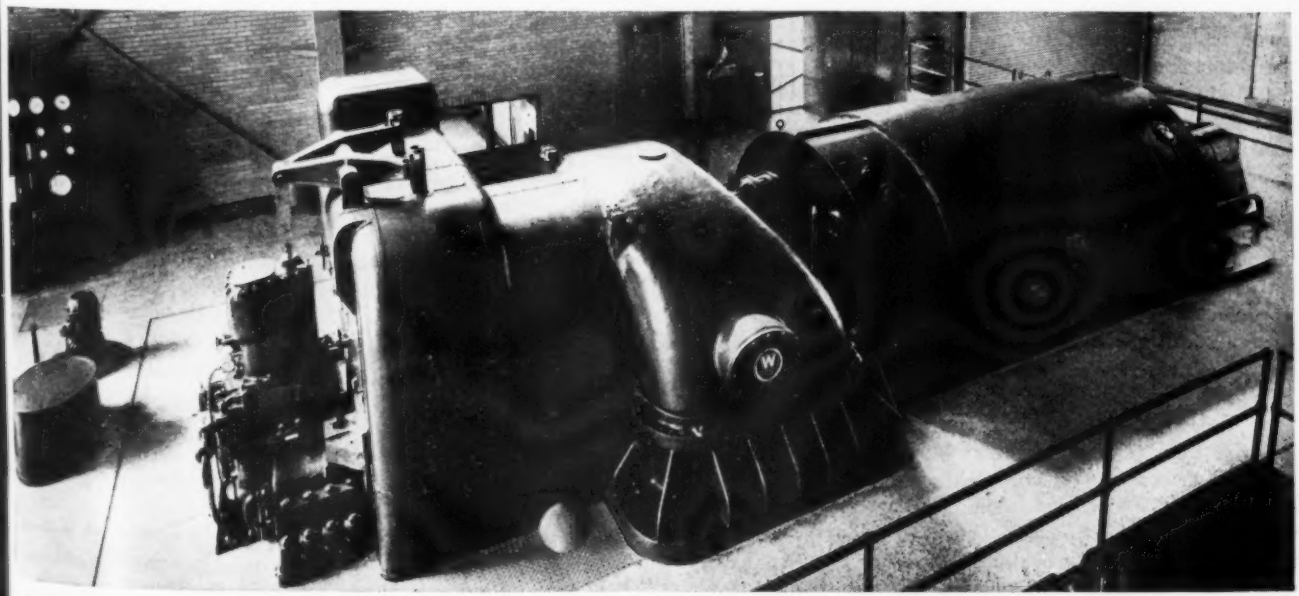


Fig. 4—A modern 3600-rmp air-cooled unit rated at 28,750 kva, 0.8 pf, typical of many that must meet heavy industrial loads in 1943

For all types of generators an indication of the amount of overload that can be carried can be had from a series of temperature tests. A prediction can be made from the results of a single temperature run by assuming that the temperature rise varies as the square of the current, but more accurate indications are obtained from runs at, for example, 50, 75 and 100% load. During these tests load among phases should be balanced, as unbalanced currents cause extra heating in the rotor and result in pessimistic prediction of allowable overload.

Test Procedure

Power factor also should be held close to the rated value so that maximum field current is required for each load condition. With all runs at the same power factor, items such as higher internal voltage are taken into account.

Instruments should be calibrated, as the comparatively wide variation normally allowed switchboard instruments may introduce too great error in extending the operating range of the unit. In particular, the resistance of the leads should be taken into account when the instruments are calibrated. In determining load on the generator, switchboard instruments are satisfactory, but portable instruments that can be read more accurately should be used for measuring field voltage and current; a slight inaccuracy in these data can lead to great inaccuracy in the extrapolated curve of temperature rise.

Take readings at the generator terminals if at all possible. In any case where line reactors are located between generator and potential transformer, the generator operates at higher voltage than indicated by the instruments and is capable of carrying more load than shown by the test data. Where any special instruments are used, the corresponding switchboard instruments should also be read so that they can be used with confidence in their accuracy after the special meters have been removed on completion of the test.

Temperature of stator coils should be taken as the highest reading obtained. On long generators it is not advisable to predict coil temperatures by the use of thermometers on the end turns as center temperatures are subject to variations in core temperature and ventilation. Also, end-turn temperatures show less rise than center-coil temperatures and any inaccuracy is multiplied. On shorter machines where detectors are not available, thermometers on end turns should be well protected from the air stream and a large number of thermometers should be used.

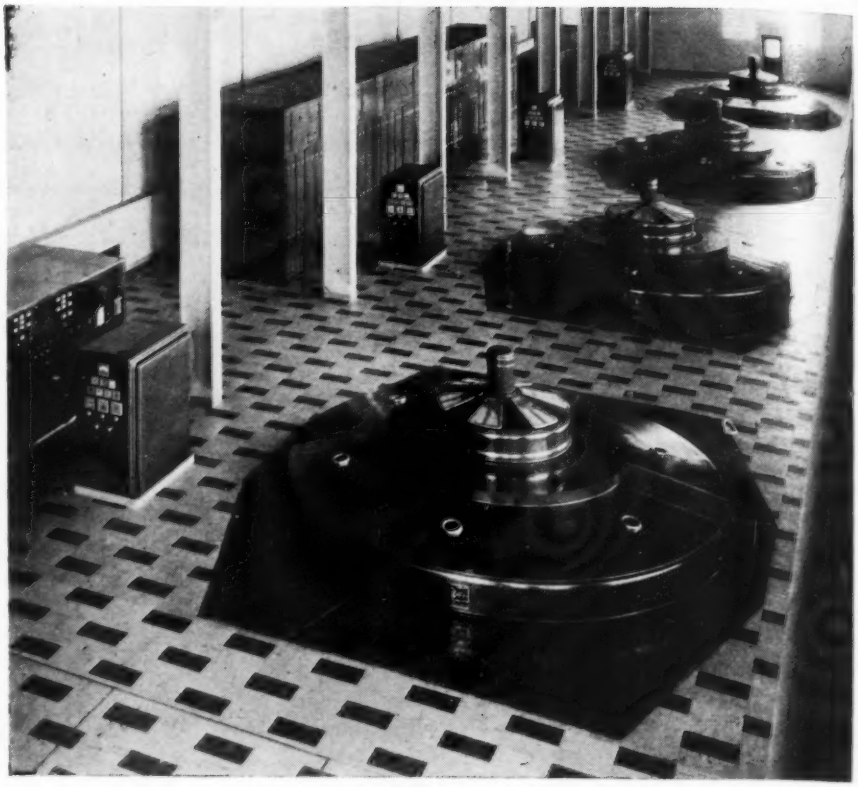


Fig. 5—Hydro units, like these umbrella-type machines totalling 75,000 kw, can carry overloads safely if careful watch assures insulation temperature limits are not exceeded

Temperature of the rotor winding should be determined by measuring the increase in resistance. If possible, the "cold" resistance should be obtained at the time the test is made. If cold resistance cannot be measured, it can be obtained from the manufacturer's records of shops tests.

For copper rotor coils, the inferred zero resistance at —234.5 C should be used in determining winding temperature. For windings partly or wholly of aluminum, the manufacturer will supply a value for inferred zero resistance for test computations.

Measuring Field Voltage

Voltage across collector rings is most accurately read from copper-leaf brushes, but these involve some hazard. Carbon brushes, insulated from the spring clip as well as from the box, may be provided, but should be inspected at intervals to insure that the surface of the brush has not become glazed, a condition which gives higher than correct voltage readings.

Voltmeter leads can be attached directly to the current-carrying brushes. Tests indicate that the average contact drop of both polarities in series is approximately three volts regardless of field current. This value should, of course, be subtracted from the voltmeter reading before hot resistance and temperature are calculated. Inaccuracy of this method is not great, as the 3-volt value should not be off by more than one volt in most cases.

If there is reason to expect the temperature of any mechanical part will become too high, a thermocouple should be attached and readings taken during test. Also, the voltage regulator should be disconnected and excitation current held constant by hand control. Rotor-winding temperature varies more widely with excitation current than stator-winding temperature. Temperature runs take 4-5 hours with readings at 15-min. intervals after conditions become stabilized within the machine.

Two curves should be drawn (1) stator-winding temperature rise against kva output and (2) rotor-winding temperature rise against kw excitation, as in Fig. 2 and 3. Extrapolation of these curves indicates at what load and excitation predetermined maximum temperatures are reached and whether stator or rotor winding is the limiting factor.

For class A insulation, standard NEMA values should not be exceeded. For class B, it is possible to exceed standard values by as much as 10 C but this should be done only in case of great necessity and then only if the insulation is relatively new. Even if insulation is new, the generator winding life is definitely shortened by increased temperatures.

What Shape Conductors for Electrical Busbars?

Busbars are more than conductors to carry current and collect dust, emphasizes William Deans, chief engineer, ITE Circuit Breaker Co, who describes a wide variety of forms and arrangements and compares their current-carrying capacity and relative structural economy in use of metal

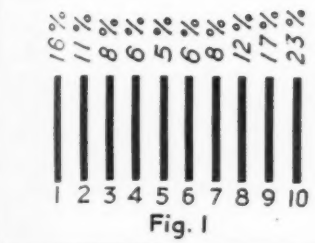


Fig. 1

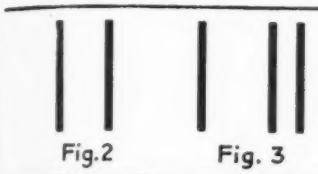


Fig. 2 Fig. 3

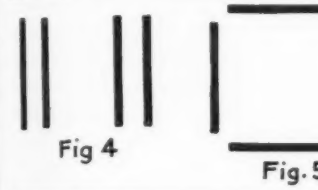


Fig 4 Fig. 5

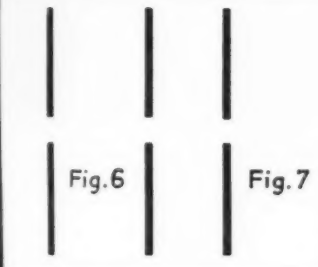


Fig. 6 Fig. 7

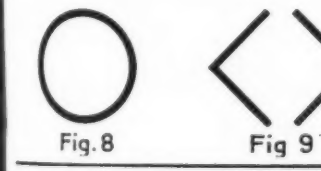


Fig. 8 Fig 9

Fig. 10 Fig. 11

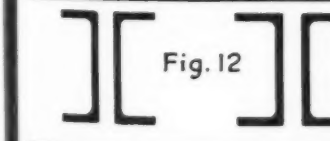


Fig. 12

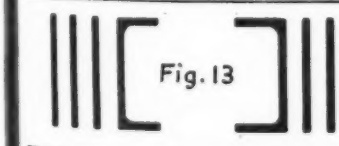


Fig. 13

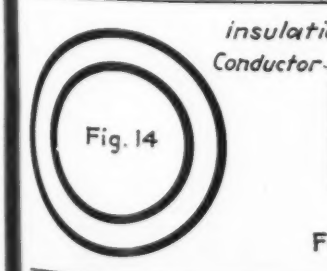


Fig. 14 Fig. 15

▶ BUSBARS PROBABLY LOOK simple to those who have never studied their design seriously. They, however, are quite complicated structures presenting both electrical and mechanical problems. with which the operating as well as the designing engineer must be familiar. Among these, particularly in buses for alternating current, and in some cases for direct current, is the cross-sectional shape of the conductors and the method of arranging them so as to use the metal in them most economically.

In alternating-current buses we do not have a uniform distribution of current over their cross-section, because of *skin effect*. This results from the self-inductance being greater at the center of a conductor than at its surface. The magnetic field of each conductor in a busbar system also reacts on the other conductors to cause an unequal distribution of current across their cross-sections. This is known as *proximity effect*.

Because of skin and proximity effect the size of a conductor for alternating current cannot be adequately specified by naming a given current density. This is also true for direct current, although less obvious. The carrying capacity of a conductor is determined by its ability to dissipate heat developed in it as a result of the current conducted. For example, on direct current it might be assumed that a 4x½-in. copper bar would have twice the current-carrying

Fig. 1—Current distribution in percent of total current in a busbar assembly of ten 4- x ¼-in. bars spaced ¼ in. apart. Fig. 2 to 13—Different shapes and arrangements of conductors used in electrical busbar structures. Fig. 14—Circular-tube bus with one tube within the other. Fig. 15—Two flat bars placed close together with a thin insulating strip between them offers a solution to problems found in long welding busbars. Fig. 16—Interleaved busbars in which each bar is insulated and arranged to carry a different phase current of a 3-phase system. Fig. 17—One form of a 3-phase bus construction, consisting of two 3-phase buses in parallel, that has its conductors close together and gives a compact low-reactance design

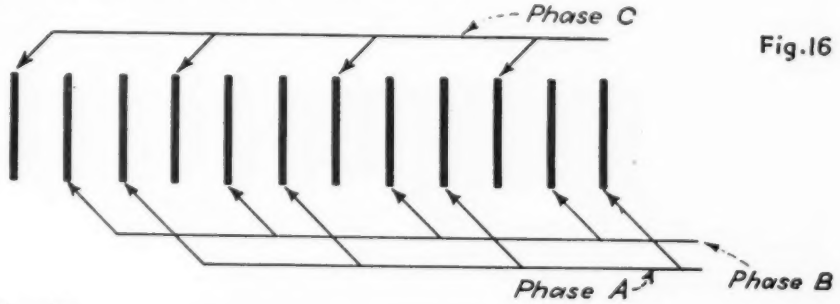
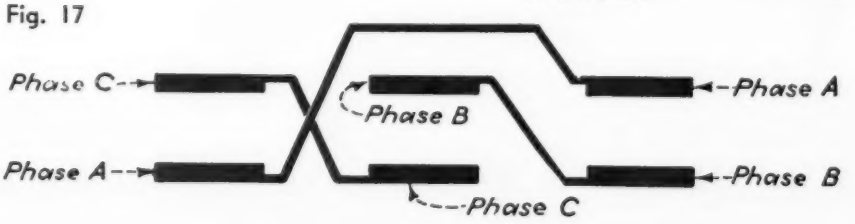


Fig.16

Fig. 17



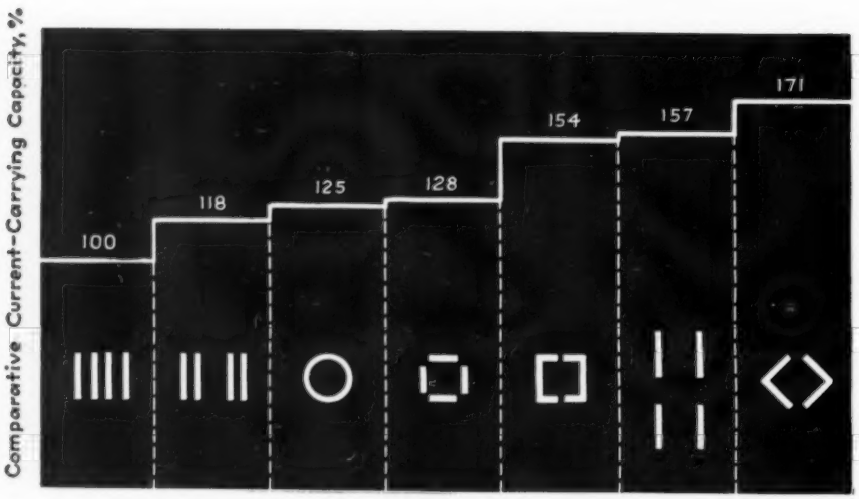


Fig. 18—Comparative current-carrying capacities of several conductor arrangements all of the same cross-sectional area and weight per lineal foot

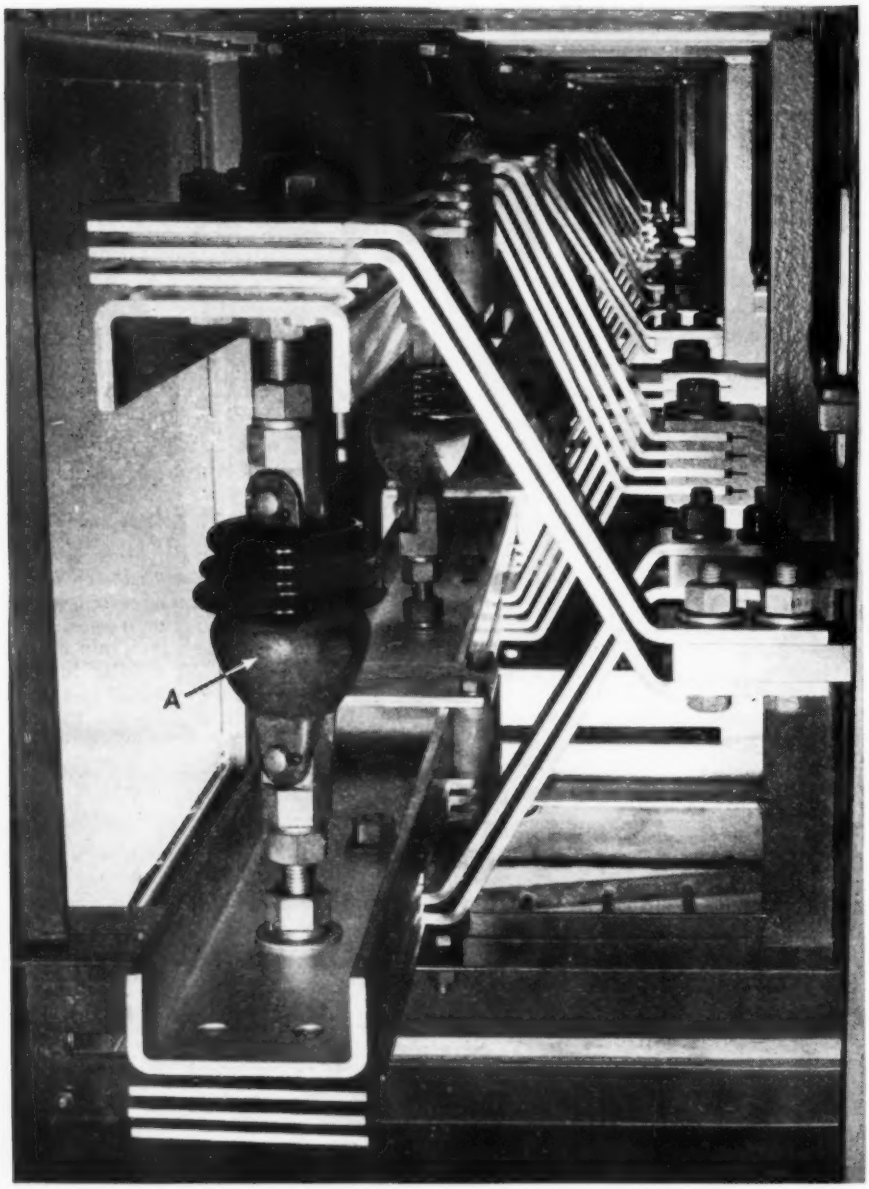


Fig. 19—Busbar arrangement in which each conductor consists of a copper channel and three flat bars. The positive and negative buses are quite close together so that they are subjected to severe forces during short circuits. Some of the heavy bracing can be seen at *A* between the two channels

capacity of a 4x¼-in. bar; actually it has only 145% of the capacity of the bar with one-half the cross-sectional area. This is because the larger bar has less than 6% more exposed area to dissipate heat than the smaller bar.

The shape and arrangement of bars in a bus structure also have marked effects on their current-carrying capacity. A flat bar is the simplest conductor for busbars. Being simple and readily obtainable makes its use attractive. For direct current, flat bars of the same thickness may be assembled, with due regard for heat dissipation, until the desired cross-sectional area is obtained. In these structures the bars are usually arranged side by side, with suitable space between and with the longer cross-sectional dimension vertical to permit air flow between the bars to dissipate the heat. In this arrangement of bars direct current will be distributed equally between them.

Alternating Current

For alternating current each bar of an assembly, consisting of many bars, as described above, does not carry equal currents. A test made on an assembly of ten 4x¼-in. bars, spaced ¼ in. apart, Fig. 1, showed a current distribution as in the figure and Table I, below. Taking the total current flow into the assembly as 100%, while the two outside bars carried 16 and 23% total current respectively, bars 5 and 6 carried only 5 and 6% of the current, respectively. If the current were equally divided, each bar would carry 10%.

From this it is evident that the center bars take far less than their proportionate share of the current and the outside bars take more. This is because the skin effect tends to cause less current flow on he inside of a conductor than on the outside. Bars 9 and 10 carry more current than bars

Table I—Current Distribution in Busbars (arranged as in Fig. 1)

Bar No.	*Percent of Total Current*
10	23
9	17
8	12
7	8
6	6
5	5
4	6
3	8
2	11
1	16
Total Percent	112

1 and 2; this is caused by proximity effect of the return conductors. The total current adds up to 112% instead of 100%, showing that the currents in the different bars are out of phase with each other and with the total current, because the reactances of the bars are unequal.

For alternating current the most efficient conductor is one that is essentially hollow. Following this theory, when flat bars are used they are usually arranged to approximate a hollow conductor insofar as the number of bars will permit. If two in parallel are required to carry the current they are set side by side a proper distance apart with their longer dimensions vertical, Fig. 2. We therefore have what might be considered a square hollow conductor with the top and bottom sides removed.

If the current requires three bars, their proper arrangement would be as in Fig. 3, one bar being farther away from two assembled quite closely together. Assembling these bars equal distances apart would be incorrect because the center bar would carry only a small part of the total current, as shown in Fig. 1. Fig. 7 shows another satisfactory arrangement of three bars. Here they are arranged in a modified hollow square and have been found to be a more efficient current carrier than Fig. 3.

Four-Bar Arrangements

When four bars are required, three arrangements are possible. Fig. 4, 5 and 6. In Fig. 4 the bars are divided into two pairs, each pair spaced relatively close together and the two pairs relatively far apart. Fig. 5 is a hollow-square arrangement and is an efficient carrier of current, but is more difficult to take taps from and make connection to than the other arrangements. Its horizontal members dissipate heat much less efficiently than the vertical ones, but the skin-effect ratio of this arrangement is good. The so-called modified hollow-square arrangement, Fig. 6, is not so good in regard to skin effect as the hollow square, Fig. 5, but because of the vertical arrangement of its bars it dissipates heat more effectively. Even though it suffers a loss of current-carrying capacity because of its poorer skin-effect ratio, its heat-dissipating qualities are so much better as to give Fig. 6 more current capacity than Fig. 5. Other arrangements of four bars have been used but those shown indicate the principles.

Besides flat bars, structural shapes, such as angles, channels and square

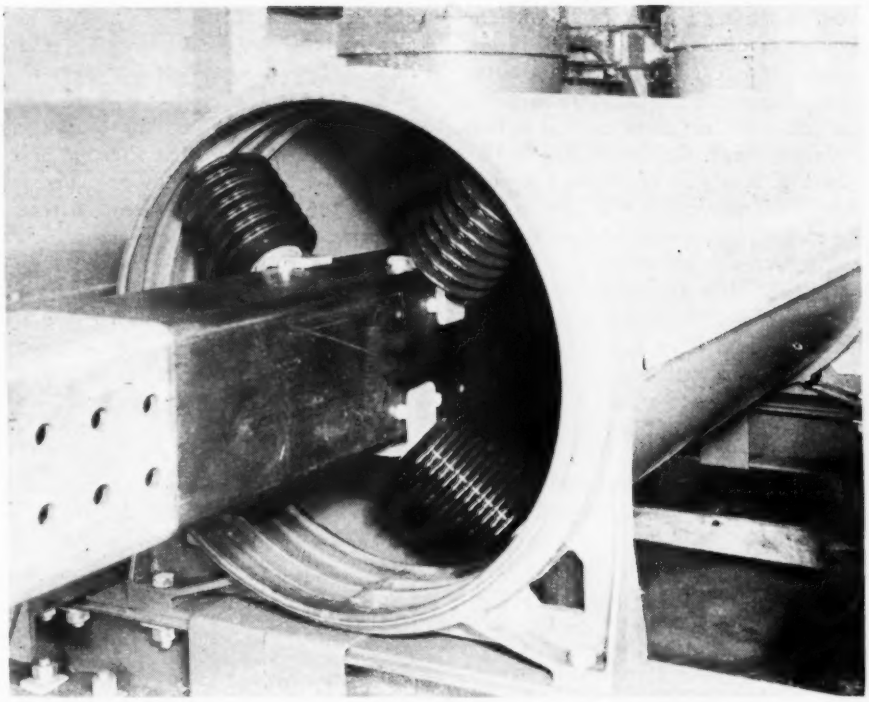


Fig. 20—Square tubular busbar supported on four insulators within a heavy metal circular support ring and totally inclosed within a circular sheet metal casing

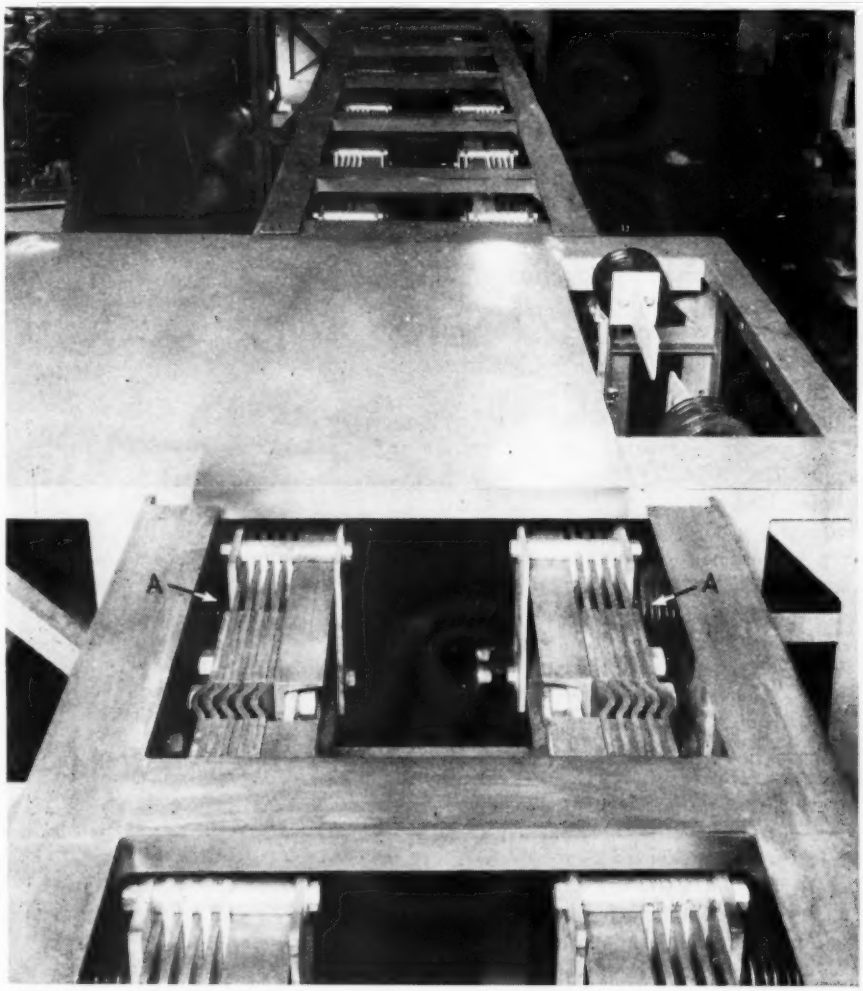


Fig. 21—Looking down on a 10,000-amp direct-current aluminum bus, each of its two conductors consisting of a channel and four flat bars. The two busbars are supported in a structural-steel frame on insulators, as at *A*

tubes, as well as circular tubes, are used. Each has merits of its own. The skin effect of the tube, Fig. 8, is low and because each of the other three arrangements are similar to a tube, the skin-effect ratios of all fall within a narrow range.

In Fig. 9, a pair of angles are positioned to form roughly a hollow square. The skin effect ratio of this combination approximates that of a tube. But, the angles are separated to allow some ventilation of their inside surfaces and for this reason have a higher current-carrying capacity than a circular tube. This also applies to a pair of channels, Fig. 10. A square tube, Fig. 11, because of lack of ventilation, is comparable only to a circular one in current-carrying capacity. Square tubes are available with holes in their top and bottom sides for inside ventilation, and weight for weight their current-carrying capacity equals that of a pair of channels.

Fig. 18 shows the comparative current-carrying capacity of several conductor arrangements all of the same cross-sectional area and weight per lineal foot. Their current-carrying capacities vary from 100% for four bars arranged in close formation, through 157% for the modified hollow square to 171% for two angles. Circular tubes, square tubes and pairs of channels present little difficulty in taking off taps from them and making connections, but they are more difficult to make on assemblies of flat bars.

Direct-Current Applications

For direct-current applications we do not have to be concerned about skin effect ordinarily and about proximity effect only during periods of short circuits or switching. Therefore, because of the greater ease of making taps and connections to them, two channels arranged back to back, Fig. 12, are frequently used for direct-current busbars. Combinations of flat bars and channels, Fig. 13, are also used where more capacity is needed than can be obtained with a pair of channels.

As long as the direct-current load remains constant, each conductor in the busbars will take its share of the total current. During the time that a fault current increases to its final value, however, proximity effect forces most of the current into the conductors nearest each other; that is, into the two inside channels, Fig. 12 and 13. A channel has a much higher section modulus that a flat bar, therefore even if the current is forced into it by proximity effect to produce higher mechanical forces, a reasonable spacing of busbar supports can be used.

The interleaved bus, Fig. 16, consists of a number of flat bars arranged quite closely together. Each bar is insulated and arranged to carry a different-phase current of a 3-phase system. This arrangement makes one of the most efficient current-carrying buses, performing on 60-cycle alternating current almost the same as on direct current.

For welding circuits and long heavily loaded buses voltage drop should be kept to a minimum. This can be done with a so-called "concentric bus," consisting of two circular tubes arranged one within the other, Fig. 14. The reactance of this combination is low, it is self contained with respect to forces between conductors, but is difficult to take taps from and make connections between sections.

Two flat bars placed close together with a thin insulating strip (sometimes only ⅛ in. thick) between them, Fig. 15 offer another solution to the problem. Such a construction would be used conveniently and efficiently for long welding buses, as it is convenient to take taps from.

Fig. 17 shows one form of a 3-phase bus construction that has the conductors close together and that gives a compact low-reactance design. This construction consists of two 3-phase buses in parallel with the paralleling connections made at equal distances along the length of the bus. Taking off taps from such a bus is a bit inconvenient, but has been solved practically and this construction is used quite generally in industrial plants.

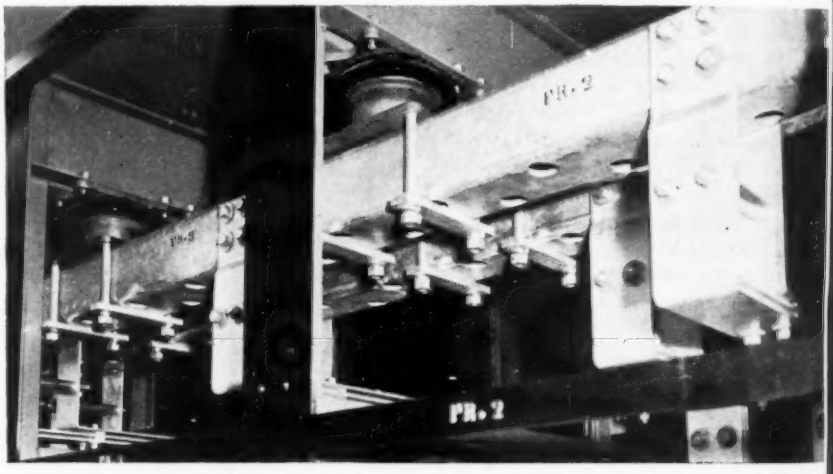


Fig. 22—A square tubular busbar, ventilated through holes in its bottom and top sides and supported on heavy insulators. Taps are taken off by using flat plates

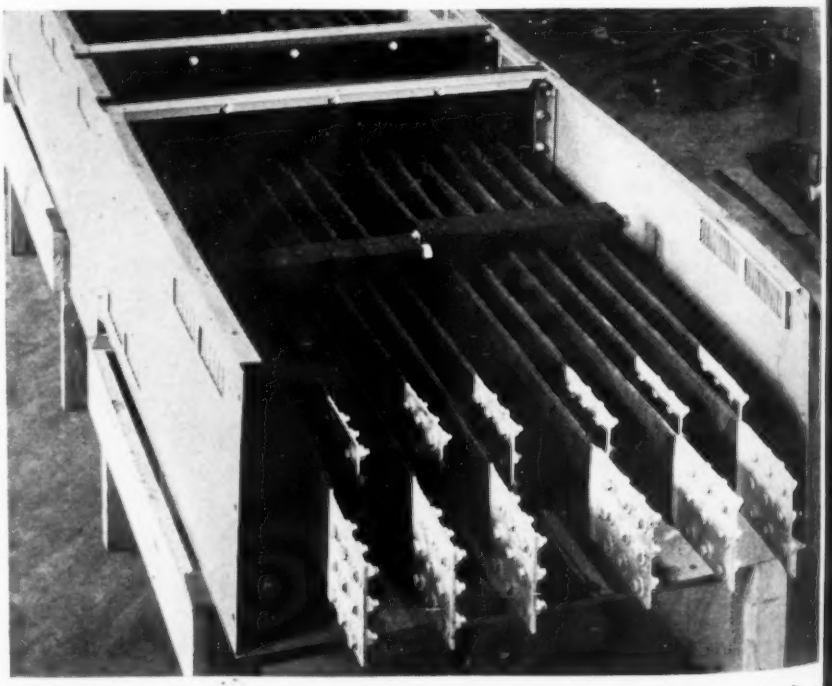


Fig. 23—A 2500-amp 500-volt 3-phase bus, consisting of twelve insulated flat bars, four for each phase, interleaved alternately *A*, *B* and *C* as in Fig. 16

More Storage Capacity Reduces Compressor Load

Excessive pipeline pressure drop lowers pneumatic tool efficiency and increases compressor operating costs. G C Tucker, Valz Granite Co, in a prize-winning paper,* tells how he reduced power costs by installing air receivers at tool supply centers

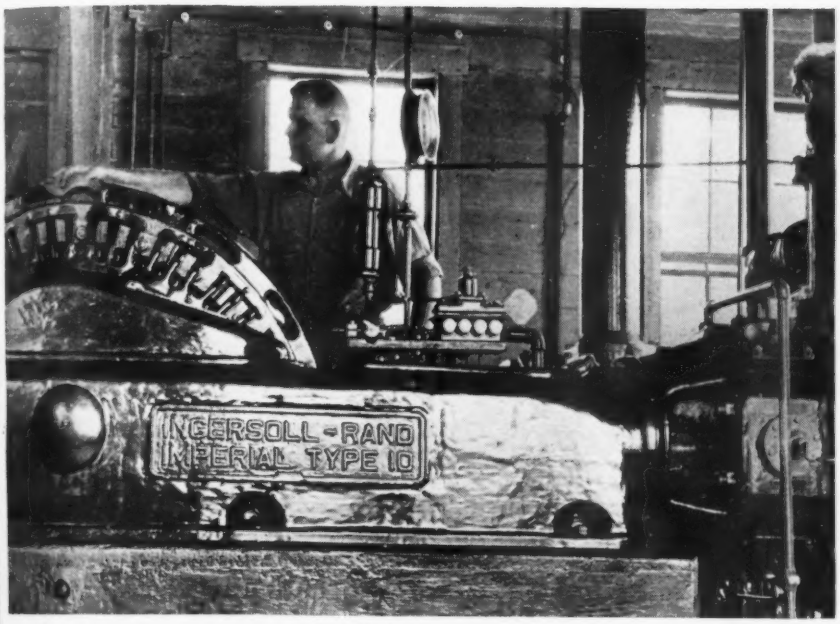


Fig. 1—This 2-stage compressor supplies the air requirements of the quarry system

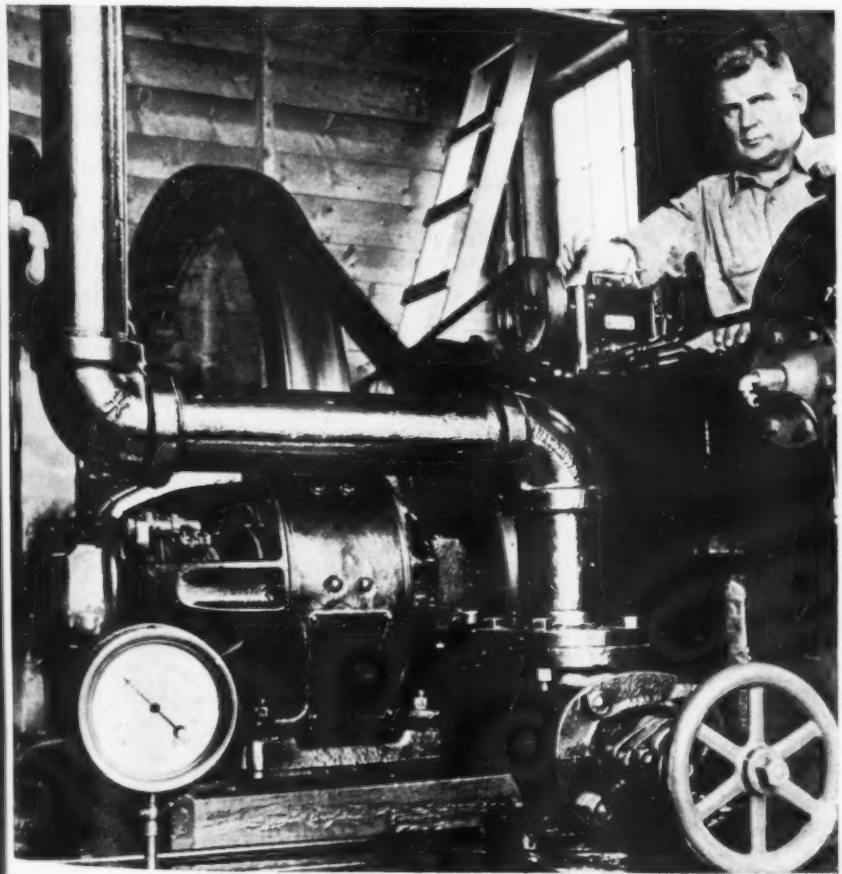


Fig. 2—More receivers permit operation at three-quarters rather than full load

► COMPRESSED-AIR REQUIREMENTS in the granite industry vary considerably during a day's operation. Quarry and plant, while going full blast some part of the time, may operate quite often at reduced output. Storage capacity located at the compressor, while adequate for minimum requirements, does not prevent excessive pressure drop in long lines during peak production. Determining whether or not additional receivers are necessary and the point at which they will serve their purpose best presents a problem faced by all operators of compressed-air equipment.

For the past 15 years I have been running numerous tests, under actual working conditions, to determine the correct ratio between storage capacity and air delivered by the compressor. Results show that with the proper ratio applied, power costs have been reduced as much as 50% and in cases where the compressors previously were not able to supply the demand for air at the tools, the deficiency has been made up. On jobs where larger compressors were thought to be necessary the proper storage ratio saved this new expense.

Value of Storage Ratio

In the Barre (Vt.) district there are about 150 air compressors varying in size from 250 to 3000 cfm. While it has been impossible to check more than a small number, in every case where the proper storage ratio has been connected the compressors have shown a marked increase in efficiency.

For a comparison consider the years 1934 through 1938. The average monthly compressor-motor meter reading was 16,233 kwhr for the 5-year period. At that time we had a fair storage ratio and operated the following pneumatic tools:

* Submitted in the "Compressed Air In Industry" contest sponsored by the Compressed Air Institute.

No.	Size	Unit capacity cfm	Total capacity cfm
3	1½ in.	30	90
2	2⅜ in.	55	110
4	2⅞ in.	85	340
30	1 in.	8	240
1	Sand Blast	115	115
1	Sand Blast	17	17
			912

Our compressor is an Ingersoll-Rand 2-stage double-acting Imperial Type XRE 18x11x14-in. 257-rpm, 1058-cfm piston displacement, 880-cfm (actual air delivered at 100 psi) unit driven by a 175-hp synchronous motor.

The following power rate shows how the bills are figured; our average monthly demand for the 5-year period amounted to 122 kw.

122 kw	at	$1.10	= $134.20
5000 kwhr	at	.02	= 100.00
7200 kwhr	at	.01½	= 108.00
4033 kwhr	at	.009	= 36.29
			$378.49

Less 5 and 5% = $341.58 average monthly bill or an average cost of $.02115 per kwhr during the test period.

Special Meter Records

The above readings are taken from the check meter on the compressor only and do not include the rest of the plant. All of our power is metered at 2300 volts on one meter at the entrance. The average cost per kwhr for the entire plant is less.

In December, 1938, we installed a new UCB 5 clearance regulator with H-balance clearance valves on the compressor. The machine ran so much better and smoother that I decided to run a new test. With the cooperation of the local power company we installed a new General Electric Type DGI meter on the compressor. A Brown Type 221-xx500 single-pen mechanically operated air-flow meter and a recording pressure gage were installed in the line. This flowmeter recorded every fluctuation in the air, showing that the demand varied from 200 to 640 cfm. The average for the six months of the test was 371 cfm.

Stop cocks inserted in the lines running from the regulator to the clearance valves enabled us to cut out any pair of valves. I tried running the unit on ½ load but found there would be short periods when the pressure dropped below 100 psi. On ¾ load the pressure held steady at 100 psi.

Increasing the storage ratio enabled the unit to carry the load with the regulator cut off at ½ stage. Since that time we have added more tools and are now running on ½-¾ load. The full-load stage is cut out completely, giving that much additional spare capacity.

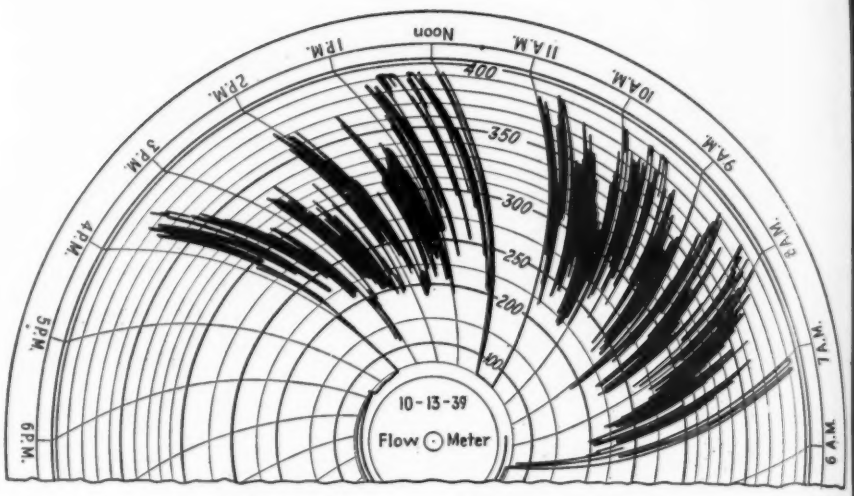


Fig. 3—Air flow after initial improvements but before making the final additions

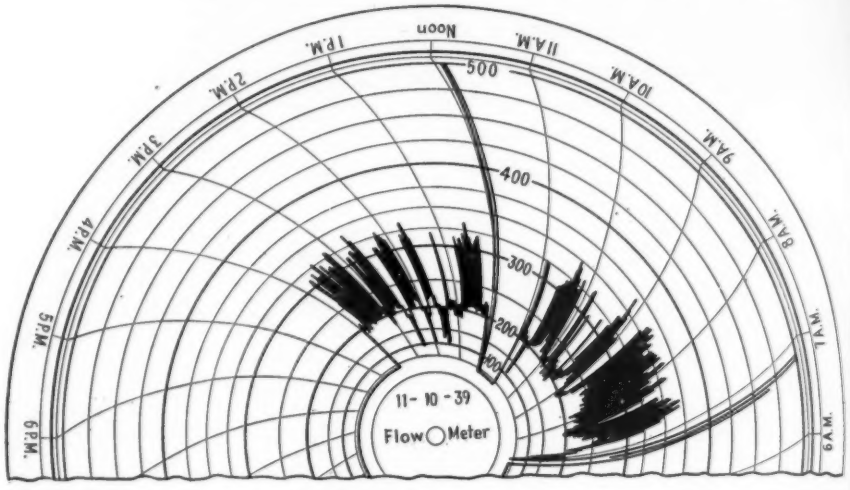


Fig. 4—Flow conditions after making the final installation of air-receiver capacity

Real Power Saving

For 1939-40-41 average monthly compressor-motor meter reading was 14,626 kwhr with a demand of 96 kw.

96 kw	at	$1.10	= $105.60
5000 kwhr	at	.02	= 100.00
4600 kwhr	at	.01½	= 69.00
5026 kwhr	at	.009	= 45.23
			$319.83

Less 5 and 5% = $288.63 average monthly power bill. Average cost per kwhr $.019734 or a saving of $52.95 per month on the power cost alone.

While no records were kept of power and air consumed previous to 1934, I know that the savings over the old 1926 method have increased many times.

Up to 1934 I put storage tanks where I thought they were needed; from 1934 to 1938 I checked the demand for air at the tools and found that pressure drop, caused by friction in the lines, could be overcome by increasing the air storage. The tests made from 1939 to 1941 supplied definite information on reducing pipeline pressure drop and increasing compressor efficiency. It is possible to use smaller compressors or keep the large ones running on the lower stages. I have found that a ratio of 5 cu ft storage to each cu ft of air delivered gives the best results. The tanks should be placed at points of greatest demand.

The flowmeter chart dated 10-13-39 shows conditions before adding the last storage capacity, and the other, dated 11-10-39, illustrates the improvements gained after completing the installation of all receivers.

Installing additional storage as reserve capacity would supply abnormal demands in plants working on defense orders where more air is needed and compressors are not available. Our experience indicates that this procedure also makes a saving in the power bill.

PUMP MAINTENANCE

By F A ANNETT, Associate Editor

Man has been a prodigious inventor and user of pumps. Maybe that is because the Creator equipped him with a most unusual pump, his heart. This pump during a Biblical three-score-and-ten life operates nearly three billion times and circulates over ninety million gallons of blood.

Even though man has not built pumps that match his heart in reliability he has probably used them more than any other device to increase the efficiency of his efforts and add to his comforts. To do this tremendous pumping job he has employed practically every kind of mechanism, including plungers, pistons, diaphragms, wobble plates, propellers, impellers, gears, screws, cams, eccentrics, and universal joints.

These pumps range from flea-power size to those requiring thousands of horsepower to drive them. Pressures range from a fraction to 10,000 psi or more. They handle practically everything that can be made to flow from the most volatile liquids, such as ether, to thick muds, sludges, corrosive acids and alkalines, molten lead and liquids at temperatures of 1000 F or higher. To meet these requirements pumps are built of gold, bronze, monel, lead, cast iron, alloy steels, rubber, stoneware, glass, enamel and many other materials.

Because of the importance of pumps in practically every industry devoted to the war effort POWER here presents a special section (No. 42) on their maintenance. To cover all aspects of this subject in the almost countless services for which pumps are used would require a large volume. By sticking to those features applicable to pumps under most conditions, we have been able to cover their maintenance in 16 pages and in addition include material on pump selection and installation, of prime importance to good operation.

Selection and Installation

TROUBLE-FREE PUMP PERFORMANCE begins with proper selection and correct installation. If a pump does not have correct characteristics, is not built of the right materials or is poorly installed, operation will be unsatisfactory. No amount of maintenance can compensate for selection and installation mistakes; faulty selection and installation lie at the root of more pump troubles than all other causes combined.

Fig. 1 shows fields of application for reciprocating, rotary and centrifugal pumps, based on pressure and capacity, as suggested by one manufacturer. Minimum pressure and capacity values have been set at 10 but this is not necessarily the lower limit. Neither do the curves represent the maximum upper limits for which these types may be built. The curves do, however, give a general picture of the fields in which the three types have been applied.

For capacities below 3000 gpm and pressures up to 300 psi the three kinds of pumps overlap as to application and seem to be in competition. However, each has distinctive characteristics which make it suited to particular services and kinds of fluids.

Centrifugal pumps deliver a given volume at a given head. If head changes, rate of discharge also changes. For example, in Fig. 2, the pump is good for 250 gpm at 60-ft total dynamic head. If the head calculation proves to be in error and becomes 70 ft instead of 60, the pump will deliver only 210 gpm in actual operation. If this is not

enough, and the pump is driven by a constant-speed motor, either the impeller must be changed or a new pump installed.

In general, rotary and reciprocating pumps can operate against higher suction heads than centrifugal pumps, although the latter have given satisfactory performance with suction lifts up to nearly 30 ft. Today we know that even the generally accepted limit of 15 ft suction lift for centrifugal pumps may not prove safe in all cases, because it depends on the pump's specific speed.

SPECIFIC-SPEED LIMITS

According to curves published by the Hydraulic Institute, centrifugal pumps designed for specific speeds above 6000 should not operate with a suction lift. Such pumps should always be located below suction-well surface at a depth depending on the specific speed. Specific speed takes into account pump capacity, head and speed, all of which are limiting factors on the suction lift against which the pump can operate.

Excessive suction lift on a centrifugal pump may cause noisy operation, cavitation that produces serious impeller erosion, and decrease in pump capacity and efficiency. Fig. 3 shows efficiency and head-capacity curves obtained from a small centrifugal pump in a laboratory test. When total dynamic suction lift amounted to 15 ft the pump developed 65 ft head and discharged 11 cfs (82.5 gpm) at an efficiency of 88%. Increasing suction head to 22 ft and retaining total dynamic head at 65 ft cut pump capacity to 10.25 cfs (77 gpm), a decrease of 6.5%. The efficiency dropped to 83%.

When the suction of a centrifugal pump operates under a vacuum, as when handling condensate from a condenser, its capacity varies widely with the amount of submergence, that is, on the suction head maintained on the pump intake, Fig. 4. With a 48-in. submergence in a 28.8-in. vacuum, this pump discharges 100 gpm against a total head of 57 ft. If the submergence drops to 24 in., pump capacity decreases to 47 gpm at free discharge, less than 50% of the capacity at 48-in. submergence and 57-ft head.

Amount of submergence exerts practically no effect on pump performance until a critical head-capacity point is reached at which the pump breaks down. For example, with 24-in. submergence, pump operation remains normal up to 40 gpm and 90 ft head. Efficiency and therefore power of the pump also stay normal. Beyond 40 gpm, head and capacity fall off rapidly until at 47-ft head capacity ceases to increase even at free discharge.

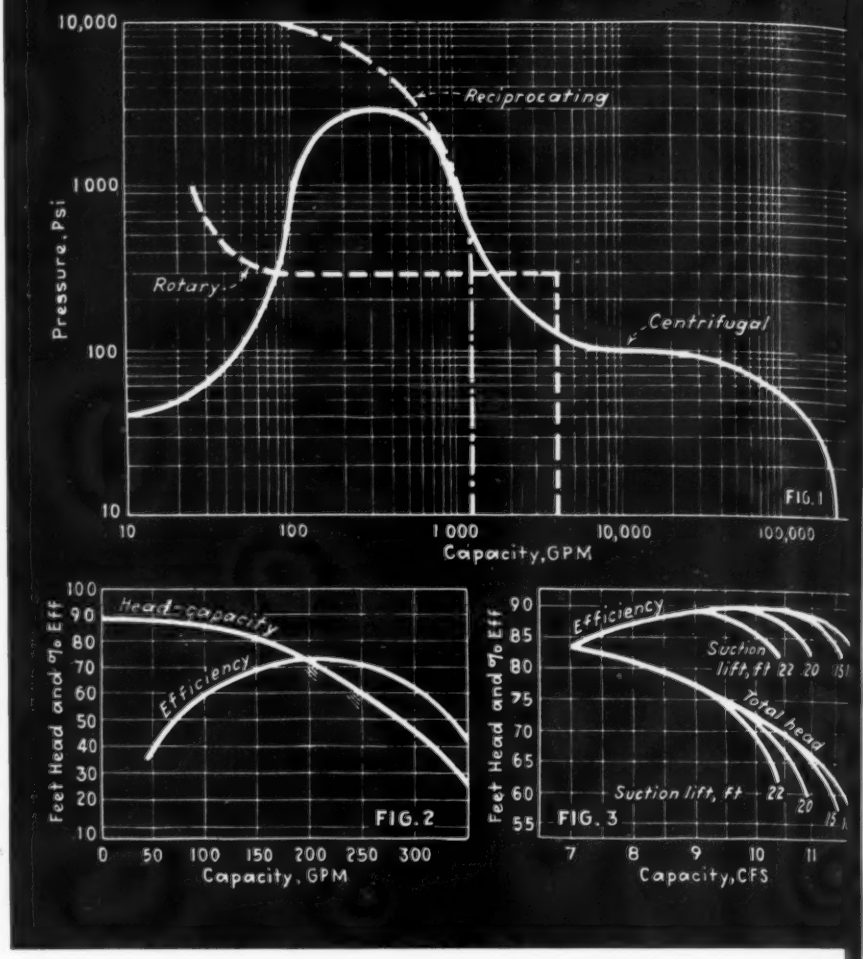


Fig. 1.—Suggested fields of reciprocating, rotary and centrifugal pumps. Fig. 2.—Head-capacity and efficiency curves for a centrifugal pump. Fig. 3—Capacity and efficiency of a centrifugal pump operating against different suction lifts

As shown by the curves, Fig. 5, temperature of liquid handled exerts a marked effect on pump capacity. With water at 180 F and zero suction head (atmospheric pressure) at the eye of the impeller, the pump operates at 100% capacity, assuming other conditions in the system correct for the pump. If the water temperature increases to 200 F at zero suction head, pump capacity decreases to 67% of that obtained at a temperature of 180 F.

LIQUID TEMPERATURE

With water at 210 F, a positive suction head of 12 ft must be maintained at the impeller eye if the pump is to operate at 100% capacity. If a suction head of only 6 ft can be obtained, then the pump discharge will be about 66% of rated cold-water capacity. For 210-F water and 6-ft positive suction head, select a pump with a cold-water rating about 50% greater than the amount of 210-F water to be handled.

From the foregoing it is evident that before selecting a pump the engineer must know not only the total head but also what the suction conditions are going to be, if he wants to avoid trouble. Suction lift or suction head on a pump does not mean the vertical distance between water level in the suction well and the centerline of the pump. It is this distance plus or minus the head losses in the suction pipe and fittings.

Where the suction-well level may vary, then the minimum level must be used in calculating the suction head or suction lift on the pump. If the static suction lift is taken as 12 ft and after the pump goes into service the suction-well level drops 3 ft, making the static suction lift 15 ft, trouble may follow.

Whenever possible locate the pump far enough below liquid level in the suction well to insure a positive head on its suction. Where this is not possible place the pump as near the supply as installation conditions will permit. Many centrifugal-pump troubles can be avoided by keeping the suction lift at a minimum. Before installing the pump read carefully the instructions furnished by the manufacturers.

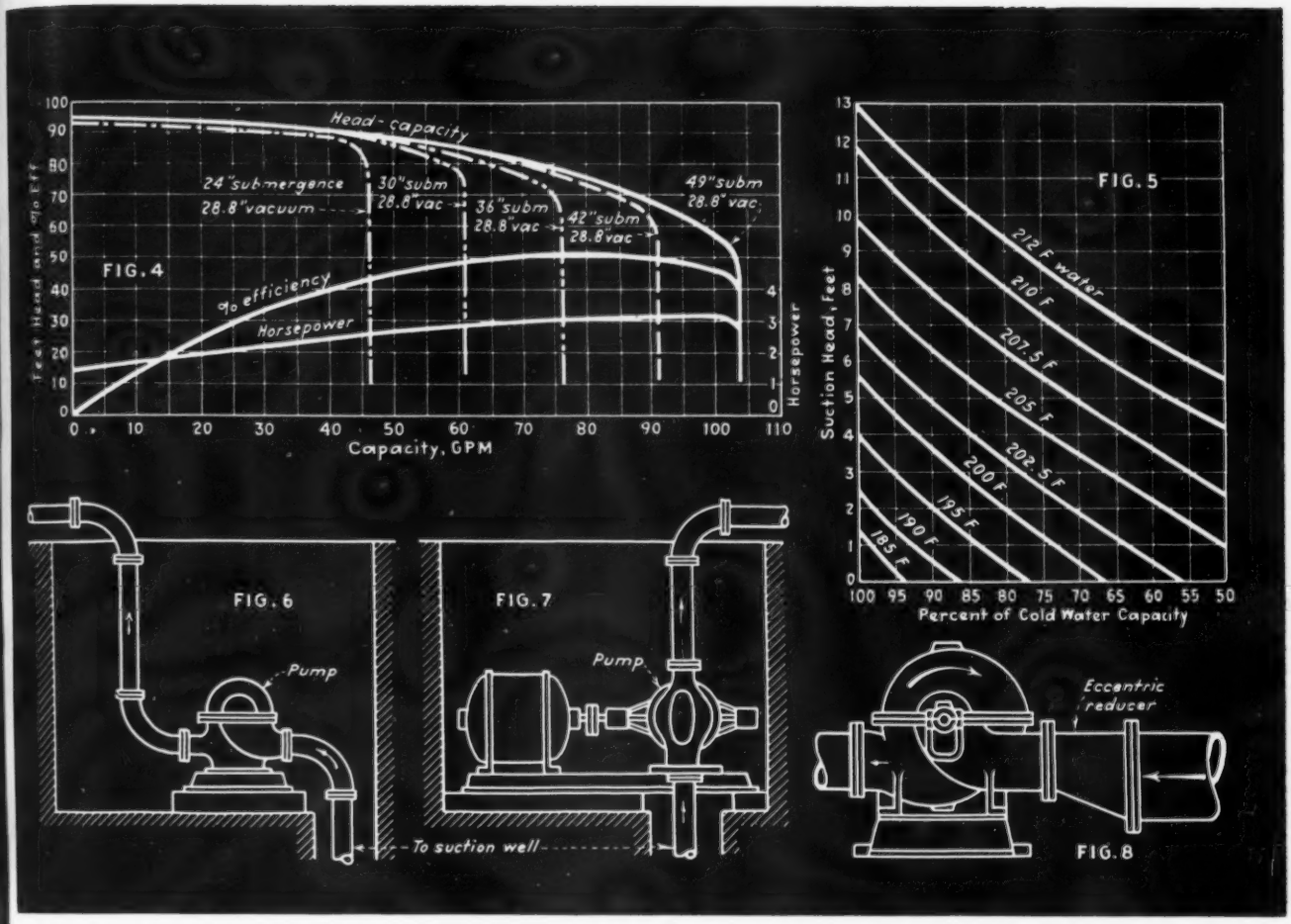


Fig. 4—Capacity of centrifugal condensate pumps varies with the amount of submergence (suction head) at the pump intake. Fig. 5—Temperature of liquid handled affects centrifugal-pump capacity. Fig. 6 and 7—Proposed and adopted pump-and-piping arrangements, respectively, for one installation. Fig. 8—Eccentric reducer at pump suction

When installing a pump never use piping smaller than the pump nozzles and preferably one or two sizes larger, especially on the suction side. It is always better to have the pipe a size too large than too small. Pipe one size too large will always pay dividends in reduced operating cost, whereas pipe that is too small increases operating costs and may cause unsatisfactory service from the pump.

RUN PIPE DIRECT

Run the piping as directly as possible to the pump. Proper attention to arrangement of the pump may help simplify the piping layout. Fig. 6 and 7 show one example of this. As originally planned several conventional-design pumps were to be installed on platforms in wells about 10 ft below the land surface. The pumps were to operate against a total dynamic head of 32 ft, of which 10 ft was suction lift, Fig. 6. After consulting the pump manufacturer it was decided to build the pump casings with the suction and discharge nozzle vertical, Fig. 7. This arrangement eliminated two elbows and reduced the head more than 3 ft, enough to make it possible to drive the pumps by 35- instead of 40-hp motors and to produce a power saving of about 9000 kwhr per year for each pump.

Never permit an upward loop in the suction line as it causes an air pocket that reduces the capacity of the pump. Fig. 9 shows a condition that actually existed. The suction line ran from a standpipe leading to a tank on the roof. A water softener was installed and a line from the standpipe connected to it for backwashing. It was expected that the roof tank would provide sufficient pressure for backwashing the softener.

When it was found that sufficient water would not flow a pump was purchased and installed but did not increase the water flow. The pump company's service engineer followed the suction line back from the pump and found an upward loop in the pipe that formed an air trap. After the loop was eliminated the pump came up to rated capacity. If a loop must be put into a pipeline make it downward as indicated by the dotted line, never upward.

When the suction line is long and the suction-well level below the centerline of the pump, have the line slope up to the pump, as shown in full lines, Fig. 10. If the pipe slopes downward, as indicated by dotted lines, an air pocket forms in the high spot and reduces the capacity of the pump or causes it to lose its prime.

PROVIDE A FOOT VALVE

When a pump operates under a suction lift, provide a foot-valve on the intake end of the suction line. This valve, if it is tight, keeps the pump primed after this is once done, and also permits priming the pump by filling the suction line and pump casing with water from a source above the pump. A pump operating under a suction lift without a foot valve can be primed only by evacuating the air from the suction line and pump, with an ejector or vacuum pump. In the absence of a foot valve install a bell mouth, Fig. 10, on the intake end of the suction line to reduce

entrance losses. Where a bell entrance is not available a pipe reducer can be used as a substitute.

Unless necessary, as when pumps operate in parallel, do not use a shut-off valve in the suction line. Never place an elbow in a horizontal plane directly at the pump suction nozzle, Fig. 11. An elbow in this position causes unequal thrust and hydraulic losses that result from the liquid tending to crowd to the outer radius of the elbow. This action tends to fill one side of the suction chamber and impeller eye more than the other. Even in a single-suction pump the elbow tends to produce eddies in the eye of the impeller.

PIPE AND FITTINGS

Between the elbow and suction nozzle connect a piece of straight pipe two to seven pipe-diameters long, Fig. 12. It is permissible to use a reducer between the long radius elbow and the pump nozzle provided the reducer is at least two pipe-diameters long. Use eccentric reducers, installed as in Fig. 8, 13 and 14, not a concentric reducer, Fig. 15. As indicated, air pockets tend to form and may be carried into the pump to cause reduction in capacity or loss of prime.

In cases where the suction is a branch from the side of a header, make the connection the same size as the header and then use an eccentric reducer as in Fig. 13. Do not make the connection the same size as the pump nozzle, Fig. 16, because an air pocket tends to form in the header.

Where the suction line comes up vertically to the pump a long-radius elbow is permissible at the pump suction nozzle, Fig. 17 and 19, but is not recommended. Avoid abrupt or sudden changes in pipeline sizes, as they tend to produce eddies and air pockets, Fig. 16 and 18. If it is necessary to change the pipe size use tapered increasers or reducers instead of flanges.

On the discharge side of the pump concentric reducers or increasers usually prove satisfactory. Whenever possible install the suction reducer and discharge increaser directly on the pump nozzles. These locations help to reduce conversion losses that might be caused by valves or elbows directly at the pump suction.

Select pipe and fittings that will keep the losses to a low value. Install a gate and a check valve in the discharge line close to the pump, with the check valve nearest the pump, Fig. 19. The check valve protects the pump against excessive surge pressures if a foot valve is used on the suction line. The check valve also prevents reverse rotation of the pump if the motive power fails when the suction line does not have a foot valve.

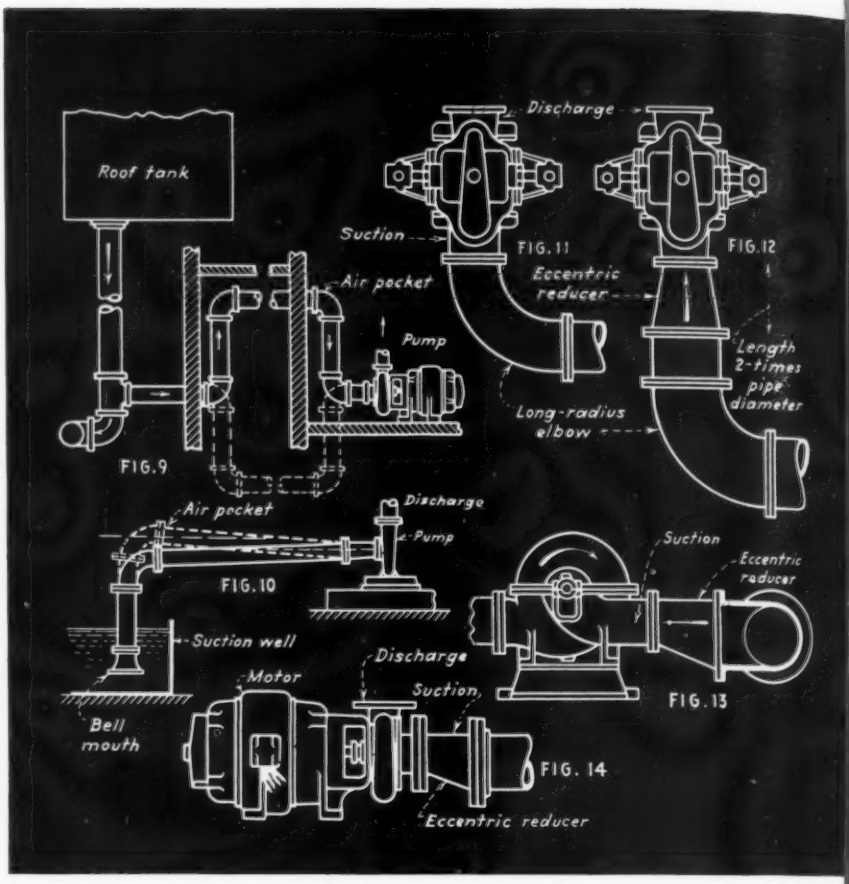


Fig. 9—Upward loop in pipe forms air trap, reducing pump capacity. Fig. 10—Slope suction pipe up to pump. Fig. 11—Never place an elbow in a horizontal plane directly at pump suction nozzle. Fig. 12—Between elbow and suction nozzle connect a piece of straight pipe two to seven pipe-diameters long. Fig. 13 and 14—Correct ways to install eccentric reducers in suction connections

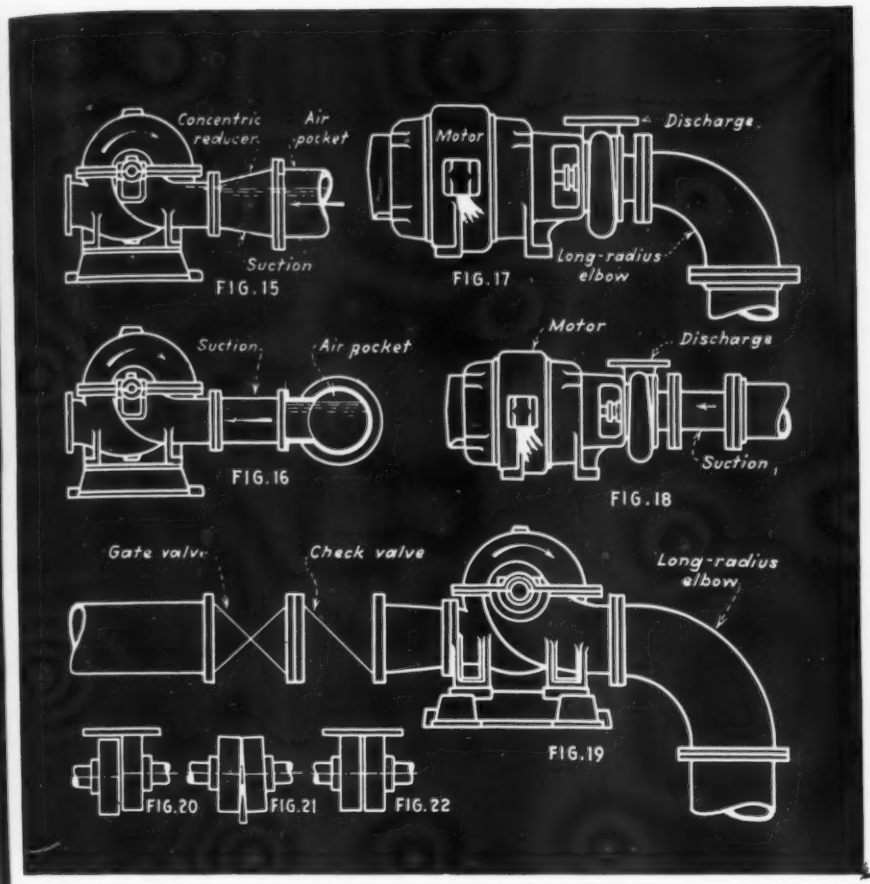
Misalignment of the pump with its driving unit, a common cause of many centrifugal-pump troubles, leads to rapid wear of flexible couplings, failure of bearings, broken shafts and other difficulties. Every pump is properly aligned with its driver on a substantial bedplate by the manufacturer before shipment. It is commercially impossible to supply pump bedplates that cannot be sprung out of alignment on an uneven foundation.

Carefully level the pump bedplate in all directions on the foundation, using metal wedges. Provide about ¾ in. space between the foundation and bedplate. When the bedplate has been properly leveled, grout it to the foundation and do not tighten the foundation bolts until the grout has thoroughly set. After tightening the foundation bolts, check alignment of the pump with its driver at the coupling, with bolts or pins removed. A straight-edge across the coupling must rest evenly on both rims all around the coupling and its two faces must be exactly parallel with a space of at least ⅛ in. between them. Fig. 22. Figs. 20 and 21 show axial and angular misalignment, respectively. Correct any misalignment by placing shims under the pump or motor. Do not insert the coupling pins until accurate alignment has been established.

Never force piping into position, by taking up on suction- or discharge-flange bolts. Such strains cause misalignment, noisy operation, short packing life and other troubles. Provide proper support for the piping to keep its weight off the pump. When pipelines are long, especially those handling hot liquids, provide for expansion and contraction of the pipeline to prevent severe strain being put on the pump that may distort its casing.

PRIME PUMP PROPERLY

Do not start a centrifugal pump until it has been properly primed. Satisfactory priming requires that all air be removed from both suction line and pump and that they be completely filled



with liquid. Never attempt to prime a centrifugal pump while it is running.

Do not set up packing too tight. Unduly tight packing causes rapid wear on the shaft sleeve. At startup, back off on the stuffing-box gland nuts until free leakage occurs. Then draw down on the gland nuts until leakage decreases to a few drops per minute. Never tighten packing to prevent all leakage. Slight leakage is required to lubricate the packing and prevent shaft-sleeve scoring. If stuffing-box drips are objectionable place a lantern ring about half way into the stuffing-box and connect it to a grease cup on the outside. The packing and shaft sleeve can be lubricated with grease.

Fig. 15 and 16—Air pockets tend to form in horizontal concentric reducers and in pipe larger than suction connection. Fig. 17—Long-radius elbow is permissible at pump nozzle if suction line is vertical. Fig. 18—Avoid abrupt changes in pipe size at pump suction. Fig. 19—Install a gate and a check valve in the discharge, with check nearest pump. Fig. 20, 21 and 22—Couplings misaligned and in line

Centrifugal Pumps

CENTRIFUGAL PUMPS OPERATE under many conditions, with the possibilities of trouble correspondingly large. Thus, it is difficult to prescribe a definite procedure for locating and correcting their troubles. However, experience shows that these troubles usually can be classified into a few definite groups, including failure to discharge, low capacity, excessive capacity, stoppage of discharge, noisy operation, seizure of impeller sealing rings, and excessive leakage through packing.

Except for mechanical troubles, nine times out of ten the causes of faulty operation will be found on the suction side of the pump. Most of these can, however, be eliminated by intelligent selection and installation of the pump, as emphasized in the previous article.

Failure of the pump to discharge may be caused by improper priming. During the priming operation all air and gas must be removed from the suction line and casing. If air is trapped in a high spot in the suction line or in the top of the pump casing, it will prevent the pump from operating properly. Here is an illustration: A pump like that shown in Fig. 1 was primed from the city-water main until water ran out of the petcocks located at the top of the casing.

When started, the pump seemed to lose its prime and did not operate as smoothly as it should. A service engineer found that the pump was being primed by completely opening the valve in the priming line and letting the water rush into the pump and suction line until it came out of the petcocks. Rapid filling trapped air that was released in the top of the casing after the pump was started. This caused a reduction in capacity. Allowing the water to run slowly eliminated the air and the trouble. When this trouble first occurred it probably could have been corrected by opening the petcocks on top of the pump to release the air.

SUCTION-LINE TROUBLE

A 1500-gpm fire pump would deliver only about 1100 gpm when started, after which capacity would gradually decrease. This indicated an air leak in the suction line, which was about 200 ft long and installed underground. After the line was exposed it was found to be perfectly tight, but it had a hump, as in Fig. 6, where air could be trapped. When this was eliminated the pump capacity came up to normal.

In process industries, air often gets into the suction line of pumps because the level in the suction well drops too low, also, through strainers and in other ways. In one case a twin strainer in the suction line had to be cleaned about every hour. Each time one side of the strainer was cleaned the liquid was drained from it and when it was closed a strainer full of air remained in the suction line. When this strainer was switched into service the air was carried into the pump and reduced its capacity, even though it operated under a positive suction head of several feet. As the pump had considerable excess capacity controlled by a valve in the discharge it was decided to recirculate some of the discharge back into the eye of the pump, in much the same manner as in a self-priming pump. To do this the sealing ring around the eye of the impeller, Fig. 4, was removed

and the impeller hub cut back about the width of the ring, Fig. 5. The pump then operated satisfactorily, ridding itself of air from the strainer.

In another case, a pump took its suction from an elevated process-liquid tank. Air entered the pump at times when the level in the tank dropped too low. This pump discharged vertically, Fig. 2, and air collected in the casing as shown. In this position the air pocket is at the beginning of flow from the volute and air cannot be picked up readily from the liquid. This trouble was corrected by turning the pump casing through 90 deg to give a horizontal discharge, Fig. 3. With the casing in this position, any air rising to its top is caught in the stream of liquid and carried out of the pump and through the discharge pipe.

AIR LEAKOFF VALVE

If trouble is experienced with air and gas collecting in the top of a pump casing, run a ⅜-in. line, with a valve, from the highest point on the pump casing to a sump, Fig. 7. Operate with the valve cracked at all times. The minimum amount of leakoff to keep the pump free of air and gas can be determined by trial. This arrangement has proved satisfactory in several installations.

When a pump operates with a suction lift, air leaking into the pump through the packing becomes a common cause of reduced capacity or loss of prime. If the packing does not have a lantern ring, and air leakage cannot be prevented without making the packing too tight on the shaft, about the only remedy lies in installing a lantern ring. In some cases a grease cup substitutes for the pressure fluid connection to the lantern ring. The lantern ring is kept filled with grease, which works out between the shaft and packing to form an airtight seal. Air may also leak between the shaft and its sleeve into the pump.

Take care to get the lantern ring properly located. Normally the ring takes the space of about two rings of packing. When it is properly placed and pushed against the packing in the stuffing-box bottom, the ring centerline should extend beyond the center of the pressure connection, Fig. 8. When the packing is fully compressed the centerline of the ring will be behind that of the pressure connection, Fig. 9. It is not uncommon to find the lantern ring behind the pressure connection in the stuffing box or to find that it was effective at first, but as the packing compressed the lantern ring moved away from the pressure connection. These conditions always result in air leakage inwards and reduction in capacity.

Make sure that the suction line is airtight if it is under a negative pressure, as this is another common trouble source, particularly on long lines. If there are valves in the suction line, as when the suction comes from two or more tanks or when pumps operate in parallel, be sure that the packing around the valve stems stays airtight.

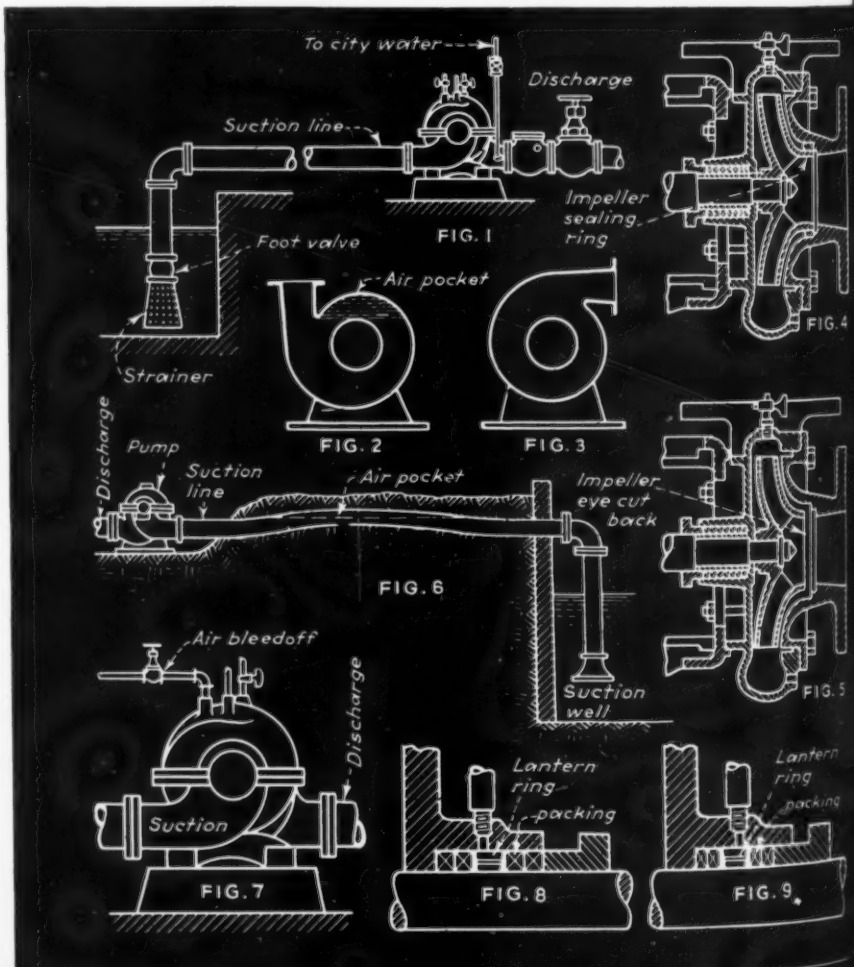
CLEAN SUCTION SCREENS

If screens are placed around the intake of the suction pipe they may clog and if not clean will cause a drop in pump capacity. In one plant where they had trouble keeping the suction-pipe screen clean they built and installed on the intake of the suction pipe a water-cleaned screen like that in Fig. 10. The strainer top and bottom are made of steel plate with holes for the 4-in. suction and 2-in. backwash pipe in the top plate. All four vertical sides of the strainer are inclosed in 18-mesh galvanized screen. A vacuum gage on the suction line at the pump shows if flow is restricted through the screen. When the gage reading begins to increase the operator shuts down the pump and opens the backwash line for one or two minutes to clean the screens.

In another plant, water flowed into a well from which it was pumped. Originally the water passed through a single screen and when this screen was removed for cleaning, leaves and small fish got into the suction well. This difficulty was overcome by using two screens; when one had to be cleaned it was moved back into the intake of the well so that the clean one could be put in front of it, Fig. 11. In this way the chamber in front of the suction pipe always has a screen.

When suction is taken from a source where the liquid level may vary, the suction-pipe intake may get so near the surface that vortex swirls will be created, Fig. 12. These swirls, if violent enough, will draw air into the pump, reduce its capacity and may cause it to lose its prime. Vortices are more likely to occur with a plain pipe intake than with a bell-shaped entrance and form more readily at high than at low veloci-

Fig. 1—Priming this pump too rapidly caused trouble. Fig. 2 and 3—Changing this pump from vertical to horizontal discharge stopped priming trouble. Fig. 4 and 5—Removing seal ring and cutting back impeller eye kept this pump primed. Fig. 6—A hump in the suction line formed an air pocket that reduced pump capacity. Fig. 7—Air bleed line from volute keeps pump primed. Fig. 8 and 9—Lantern-ring position before and after compressing packing



ties. The end of the suction pipe should be at least 3 ft below the level of the suction well. Where a pump may have to operate with low submergence of the suction-pipe intake, use a bell-shaped entrance. Vortices can also be prevented by floating wooden boards on the water surface.

INSTALL PRIMING TANK

If the suction lift is too high on a pump the things that can be done to correct it include installing larger pipe, running the pipe as directly as possible, installing a priming tank, or moving the pump closer to the suction well. Fig. 13 shows one method of applying a priming tank, which in one installation was 3 ft in diameter and 4 ft high. A float-operated switch controls operation of the vacuum pump that evacuates the tank and keeps the pump primed. This float switch is located so that it stops the vacuum pump when there is about 3 ft of water in the tank and starts it again when the water level drops about 1 ft. Any air trapped in the top of its volute when the centrifugal pump first starts is released through the petcocks, after which the pump remains primed.

Other causes of a pump losing its prime when handling cold water include increased temperature of liquid in the pump if the discharge is throttled to a small part of normal and presence of impurities with a flash point below that of water. These impurities are released under the low suction pressure existing at the impeller eye. While a centrifugal pump may handle considerable air or gas when operating at full capacity, air and gas accumulate in the eye of the impeller or in the high part of the volute and eventually cause loss of prime at reduced flow.

If there is danger of a pump losing its prime and operating that way, install automatic priming equipment. A centrifugal pump operating dry will seize its sealing rings, burn the packing and score the shaft sleeve. Automatic priming devices may be built into the pump, in which case it is a self-priming type, or installed separately, Fig. 13.

If a foot-valve is used be sure it operates properly. Trash may prevent the valve from opening and closing correctly. Cases are on record in which the threaded end of the pipe extended far enough into the valve to prevent full opening.

When a pump is properly primed and still does not discharge rated capacity the suction lift may be enough to reduce the pump's capacity (See Fig. 3 and 4, page 82). If a mistake has been made and the suction lift is too high the total head probably exceeds that for which the pump was designed at rated capacity. This is a common cause of pumps failing to discharge rated capacity. Total dynamic head may be checked while the pump operates with accurate gages connected in the suction and discharge lines. If the head exceeds that marked on the nameplate of the pump, change the pump or its impeller for one that meets existing conditions unless pressure can be reduced by changes in the piping.

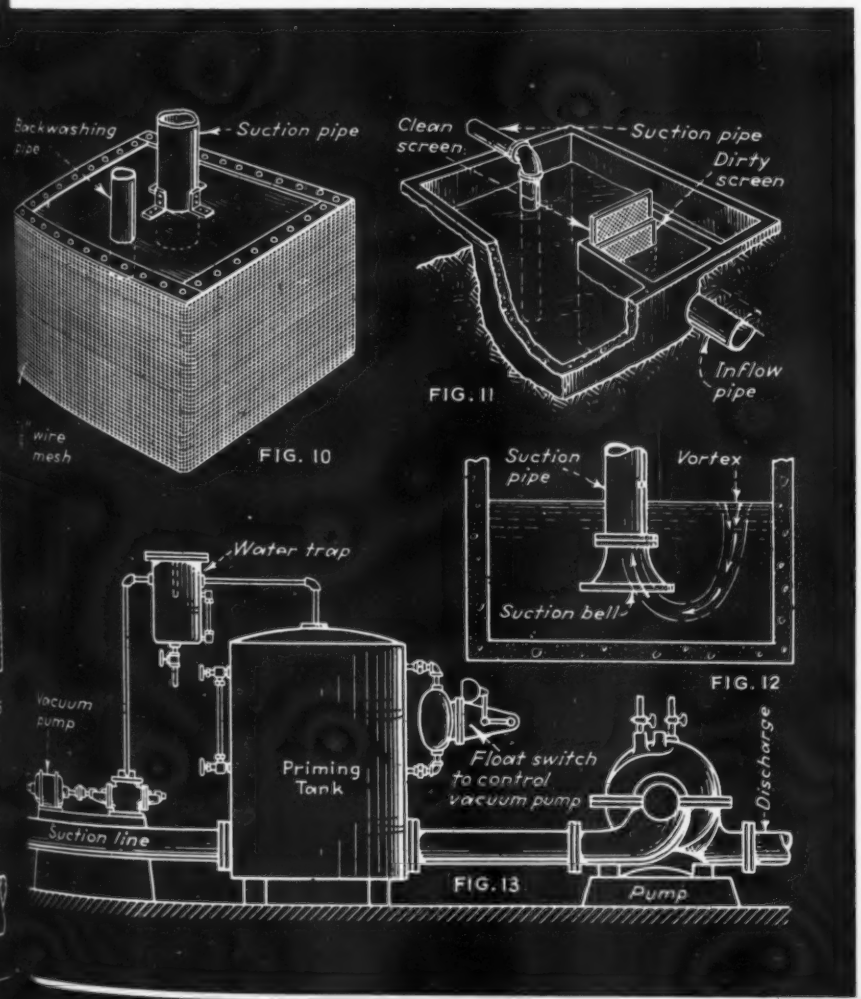
When the head remains within the limits of the pump and it discharges at less than the normal rate, the impeller may be running in the wrong direction. The impeller of a centrifugal pump must always rotate in the direction of the water flowing in the volute, toward the discharge nozzle. Reversed rotation reduces the head to a small part of that obtained with correct rotation, as indicated by Fig. 14. Head-capacity curve *A* shows pump performance with correct impeller rotation and curve *B* indicates reverse rotation. If this pump had been installed to deliver 60 gpm against a 40-ft head, curve *A* shows that the pump would meet these conditions, but on reverse-rotation curve *B*, it would develop only 35-ft head at shutoff.

Modern pumps have an arrow cast on their casings to indicate correct direction of rotation, Fig. 16, which leaves no valid reason for operating a pump in reverse direction.

REVERSED IMPELLER

After an impeller has been removed for repair or replacement, sometimes it is turned around and put on backwards. Whereas reverse rotation causes a large decrease in head and capacity, Fig. 14, reversing the impeller on its shaft produces a large decrease in capacity only, Fig. 15. For example, with the impeller installed properly the pump discharges 275 gpm at 120 ft head but discharges only about 170 gpm at this head with impeller reversed. This may be a baffling problem to locate because it cannot be found without opening the pump. Both these troubles occur frequently enough to make them among the first to check when reduced capacity occurs in a new or repaired pump.

Fig. 10—Where trouble was experienced keeping dirt and debris out of the suction pipe a water-cleaned strainer did the job. Fig. 11—A double screen made it possible to keep this suction well free of dirt. Fig. 12—When the suction line intake is too near the liquid level, vortices may form through which air enters the pump. Fig. 13—When it is difficult to keep a pump primed a priming tank may solve the problem



Fouling of the inside of the suction and discharge piping, a drop in suction-well level and other changes may cause a centrifugal pump no longer to deliver its rated capacity. If the increased head is not too great, minor changes in the pump or impeller will probably permit the unit to meet the changed conditions.

As an example, the full-line curves in Fig. 18 show the characteristics of a 6-in. pump installed to deliver 800 gpm at 90 ft head. After the pump was installed a vacuum gage on the suction and a pressure gage on the discharge showed a total head of 95 ft. The head curve indicates that the pump delivered about 680 gpm only.

Apparently nothing could be done to reduce the head on the pump except change the piping to a larger size. However, a less expensive way was found, namely, to cut back the impeller vanes at their discharge ends, as in Fig. 19, as manufacturers sometimes do when pump tests indicate that it is slightly under rated capacity. The solid lines show the original outline of the impeller. By chipping and filing back the ends of the vanes, as indicated by the shaded area, the capacity of the pump was increased the desired amount as shown by the dotted curve, Fig. 18.

WORN SEALING RINGS

Wear between impeller and casing sealing rings, such as at *A*, Fig. 17, decreases pump capacity by permitting part of the discharge to flow back into the suction. Repairing or replacing the worn rings is the obvious answer here. If the rings wear rapidly because of the presence of abrasive solids in the liquid, replace the rings with ones made of material that has high abrasion resistance, or face the old rings with such material.

Noisy operation of centrifugal pumps is frequently accompanied by vibration. The trouble in its milder forms may be caused by air in the pump and can be relieved by opening the petcocks at the top of the casing. When pumps operate under heads considerably less than those for which they were designed, the flow may be so distorted in the pump as to cause cavitation. At some points in the pump the pressure drops below the vapor pressure of the liquid and a bubble forms. When the bubble moves into a high-pressure zone it suddenly collapses and the resulting water hammer subjects the surface of the impeller to a heavy blow. This action may cause noise, severe vibration and a wearing away of the metal in the region where cavitation occurs. Cavitation may also occur in pumps not properly designed for the service assigned to them.

Vibration in a 3600-rpm boiler-feed pump was traced to impeller unbalance caused by a bent shaft. The impeller was removed and the shaft straightened in a lathe. When returned to service the unit still vibrated badly and when it was dismantled again the shaft was found bent as before.

It was at first thought that end clearance between bearings for shaft expansion was insufficient. The trouble was finally found to be caused by the impeller hub faces not being parallel with shaft collars and clamp-nut faces, *A* and *B*, Fig. 20. Each time the nuts were tightened they caused a slight bend in the shaft. Machining the faces true cured the vibration.

An 800-psi oil pump started vibrating after 13 months of smooth operation. This trouble was traced to a worn hydraulic balance disk, shaft bearings and the flexible coupling, the latter being of laminated-metal disk type. The disks had been distorted and took a permanent set that made them act as springs. This produced rotational pulsations in the impeller speed that magnified rapidly once they were started. Replacing the worn parts and distorted coupling disks restored the pump to original smooth operation. Vibration in another pump of this type for a higher pressure was found to be caused by lack of proper support of the discharge pipe adjacent to the pump.

CHECK ALIGNMENT

Other causes of vibration include misalignment of the pump with its driver. At the high temperatures at which boiler-feed and hot-oil pumps operate expansion greatly magnifies any misalignment that exists when the pump and its driver are cold. Check final alignment when the pump and its driver are at operating temperature.

When the impellers are removed from the shaft of a multi-stage feed pump and are not put back in their original order, cavitation and vibration may result. Normally the first-stage impeller has a larger entrance area to handle design capacity without cavitation. If the impellers are switched around, the

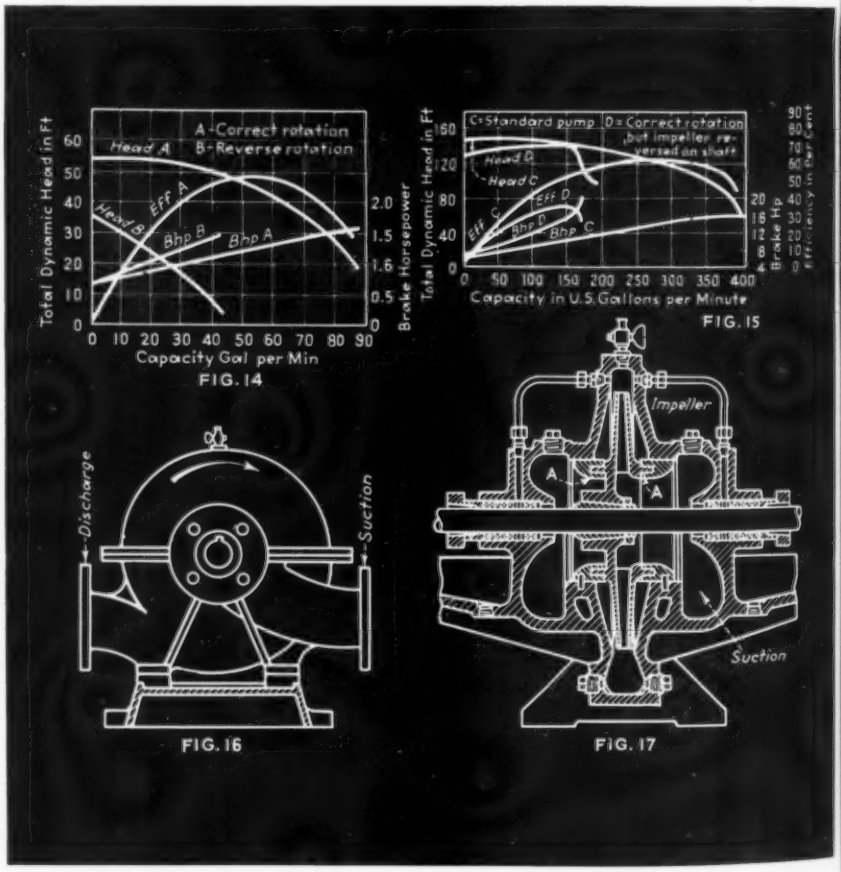


FIG. 14 FIG. 15 FIG. 16 FIG. 17

Fig. 14—Characteristic curves of a centrifugal pump operating in correct and in reverse direction of rotation. Fig. 15—Characteristic curves of an impeller properly installed on its staft and when it is put on reversed. Fig. 16—Arrow on pump casing indicates correct direction of impeller rotation. Fig. 17—Worn sealing rings at *A* permit excessive leakage from discharge to suction

first-stage impeller because of its smaller eye, would probably be subjected to severe cavitation.

Not infrequently operators experience trouble keeping the stuffing box properly packed. To get the correct packing for the application consult the pump or the packing manufacturer, or both if serious trouble arises. Assuming that the correct packing is used there are several mechanical causes for short packing life or for its failing to remain tight. Before packing can be expected to remain tight conditions in the stuffing box must be right. The best packing cannot compensate for mechanical defects in the pump.

PACKING MAINTENANCE

The impeller shaft must be smooth and run true and the stuffing box must be concentric with the shaft. An out-of-balance impeller may cause the shaft to run out of true. A shaft may be bent or its sleeve may be eccentric. Even though the shaft may run true at slow speeds it may tremble and whip at high speed because of impeller or coupling unbalance, or an object may be lodged in the impeller. Tests have shown that shaft gyration greatly shortens packing life.

Assume that when packing is tightened it contacts the shaft circumference with equal pressure. As the shaft rotates its high side compresses the packing on each revolution. At 1800 rpm the packing is compressed an equal number of times per minute with the result that the shaft soon batters a hole in the packing larger than its diameter, and excessive leakage occurs. Tightening the packing to reduce the leakage gives only temporary relief because the shaft gyration soon batters excessive clearance between the shaft and the packing.

Probably few engineers appreciate the severe treatment that worn bearings, unbalanced rotors and eccentric shaft sleeves impose on packing. Experience shows that the pump shaft must run true to within 0.002 in. to avoid packing troubles.

Misalignment of the pump with its driving unit may also cause packing trouble. A loose impeller, or one that rubs the diffuser rings in a turbine pump, will cause shaft vibration and packing trouble.

When the shaft sleeve section in the stuffing box becomes scored it is impossible to keep the packing tight enough to reduce leakage to a permissible amount, or to get reasonable life from the packing. Tightening the packing only forces it down on the shaft to be cut to peces again in a short time by its scored surface.

Occasionally packing seems to disappear from the stuffing box. Don't blame the packing before inspecting the clearance between the shaft and the hole through the bottom of the stuffing box. This may have worn so large that the packing can gradually be pushed into the pump. Clearance between the bushing in the bottom of the stuffing box and the shaft should be only sufficient to make a good running fit between the two surfaces.

Probably more packing has been spoiled by tightening the gland follower excessively than in any other way. If the packing rings are properly installed and seated the follower should bear evenly on the last ring and be parallel and concentric with the shaft.

When there is a lantern ring in the packing, piped to the discharge of the pump, make sure that its connections are not plugged with dirt. If these connections are stopped, water cannot get to the packing and it probably will overheat and permit air leakage into the pump. When a pump handles water containing considerable sediment and a clean source of water is available, connect it to the lantern ring to keep the sediment away from the packing.

FLUSH LANTERN RINGS

In one plant sand from the water in the pump lodged in the lantern ring and cut the packing and shaft sleeve. To correct this, sealing water was taken from a clean supply. To dispose of any solids that might get into the lantern ring, a drain pipe with a valve was connected into the stuffing box below the ring, Fig. 21. Opening the drain valve once a week flushed the lantern clean. This practice cured the trouble.

Every pump manufacturer is anxious that his equipment give a good account of itself. Considerable expense is incurred in dispensing engineering advice, instructions, and in many cases, supervising installation and initial operation. Full cooperation between manufacturer and consumer will ensure maximum satisfaction from the equipment and remove the cause of a lot of trouble for both.

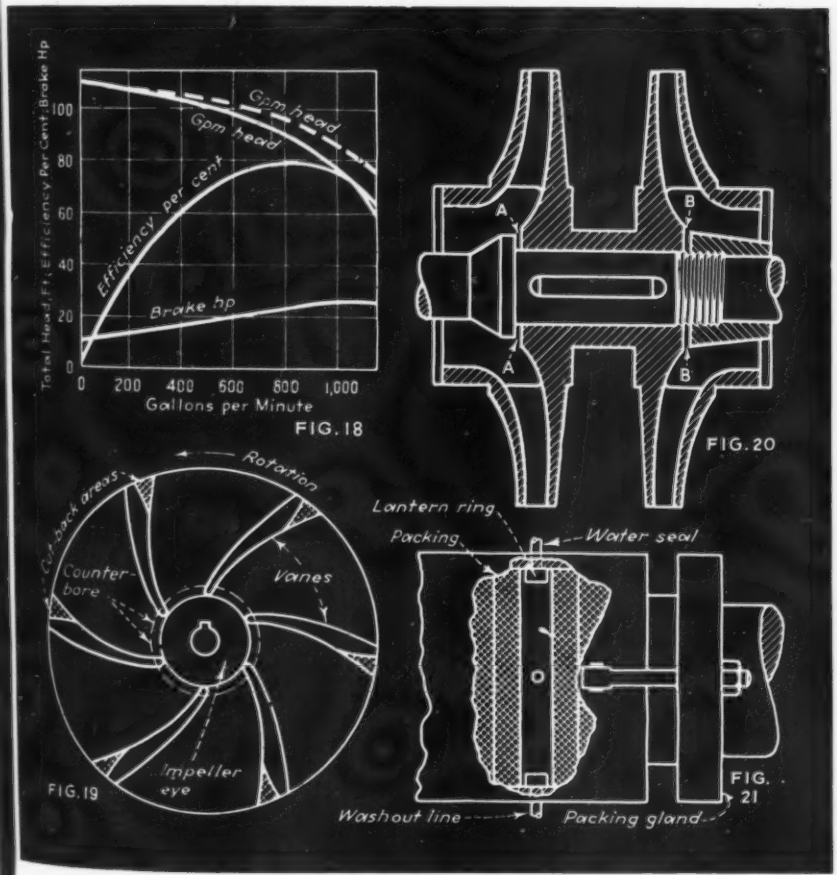


Fig. 18—Dotted curve shows changes in pump head and capacity obtained by cutting back impeller vanes. Fig. 19—Cross-sectioned areas show how the trailing discharge ends of the impeller vanes were cut back to increase pump capacity in Fig. 18. Fig. 20—Bent impeller shaft resulted from surfaces at *A* and *B* not being parallel. Fig. 21—Washout line keeps lantern ring free of dirt

Reciprocating Pumps

SMALL AND MEDIUM-SIZED reciprocating pumps may be divided into two general classes: direct-acting steam-driven, and power (motor) driven. The water ends of both include the same designs and therefore have the same troubles. On direct-acting types we also have to deal with troubles on the steam end and on the power type, the troubles of the power unit, usually a motor. The latter will not be considered here.

Many of the causes of trouble with centrifugal pumps, outlined on pages 85 to 89, apply to reciprocating pumps, particularly those associated with the suction pipe and alignment.

Reciprocating pumps can operate against high suction lifts (22 ft or more) but when the suction lift exceeds 15 ft or the suction line is long, install a foot valve to avoid having to prime the pump at starting. A vacuum chamber steadies and aids the suction flow and is recommended for high suction lifts or long suction lines. When pumps run at high piston speed a vacuum chamber is necessary to keep them from pounding. Best effect from a vacuum chamber is obtained from mounting it on the pump opposite the suction connection, Fig. 1. It may also be placed on the dead end of a tee with good results, Fig. 2. On large duplex pumps the vacuum chamber may be installed on top of the pipe that connects the inboard end of the two suction chambers, Fig. 4. When the vacuum chamber is placed in a straight pipe as in Fig. 3, much of its effect is lost.

USE AIR CHAMBER

For smooth operation, air chambers are necessary on single-acting and high-pressure pumps. These chambers must be equipped with a gage glass so that height of water may be seen. Frequently trouble results when the water absorbs the air in the chamber, letting the chamber fill with water and destroying the cushioning effect of the air. To insure that the air chamber will remain effective, keep it charged.

This can be done from a compressed-air source, as in Fig. 5. When the attendant sees the water getting high in the air chamber he opens the valve and admits compressed air until the chamber is about 75% filled. When the pump does not operate continuously, the water may be drained from above the discharge valves and the space above the valves and in the chamber filled with air.

A device known as a *snifter* may be used to keep the air chamber charged automatically, Fig. 6. This device comprises a length of 2- or 3-in. pipe P connected to the pump as shown. The top of the snifter connects to the base of the air chamber and the lower end between the suction- and discharge-valve decks. Check valves C and C_1 and globe valves V and V_1 connect in the lines between the snifter cylinder and pump. Check valve C sets so that air can flow into the snifter cylinder and C_1 permits the air to be forced from the snifter to the air chamber.

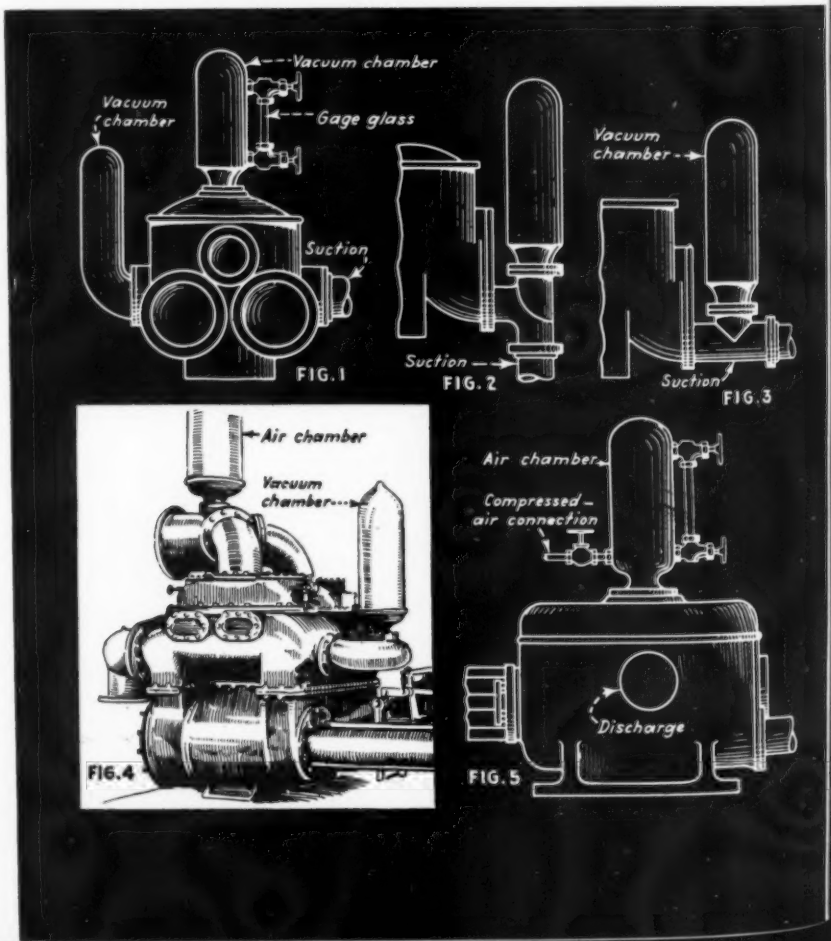
With the head end of the pump on suction, air flows into the snifter through check valve C. When this end of the pump discharges, air is forced from the snifter through check valve C_1 into the air chamber, when the water rises in the snifter cylinder. Adjust valve V_1 so that some water remains in the snifter cylinder at the end of the suction stroke to act as a piston to force the air into the air chamber on the discharge stroke of the piston.

Worn or improperly seated valves permit large leakage from the discharge to the suction. Pump valves come in a wide variety but for cold water usually consist of some design of a disk on a flat seat. Most of these seats have radial arms and in some plants it has been found that these arms may prevent proper seating of the valves after they have worn slightly. Undercutting the radial arm of the valve seats, as in Fig. 7, cures this trouble.

DEPOSITS ON VALVES

In applications where water carries a lot of solids these may form hard deposits on the valves and valve seats and prevent proper seating. In one plant where this trouble occurred, the operators made a grinding head and drove it by an electric drill to condition the valve seats in place. The grinding head consisted of two metal disks that could be clamped together by two tap bolts, Fig. 9, to hold the grinding cloth. A mandrel with a collar on its

Fig. 1, 2 and 4—Correct ways of connecting vacuum chamber to suction of reciprocating pumps. Fig. 3—Incorrect way to connect vacuum chamber on suction of reciprocating pump. Fig. 5—Compressed-air connection provide a convenient means of keeping the discharge cushioning chamber charged



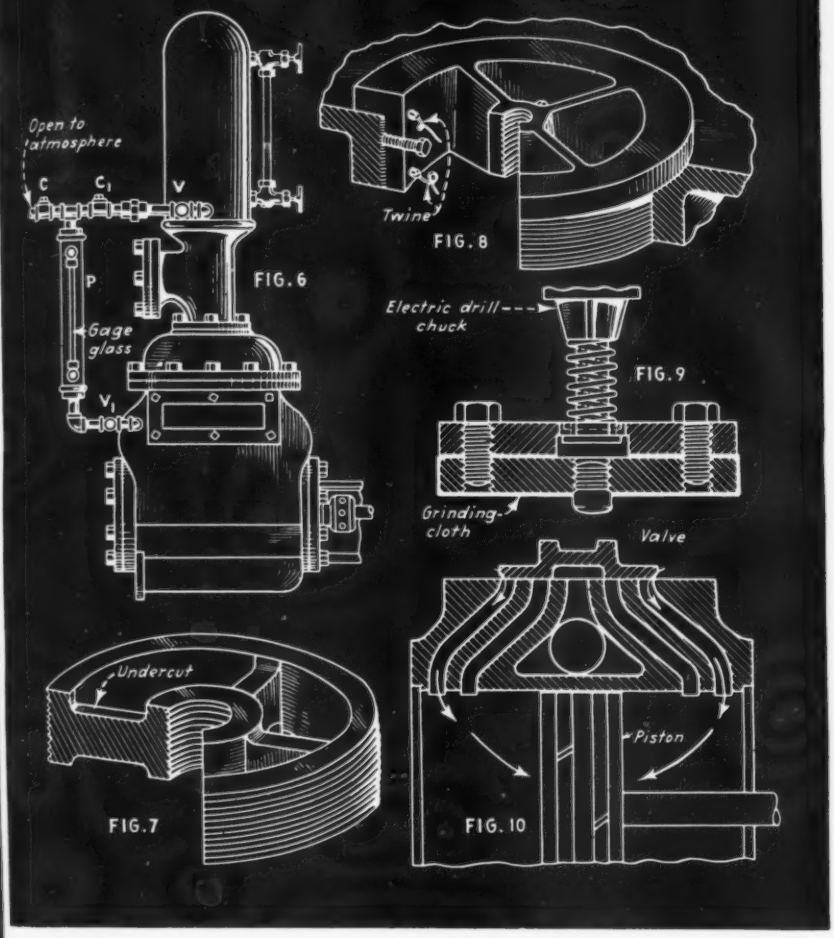


Fig. 6—Snifter may be used to charge the air chamber automatically. Fig. 7—Valve-seat arms undercut to permit proper seating of the valve. Fig. 8—Valve seat held in place by tap bolts. Fig. 9—Grinding head cleans valve seats. Fig. 10—Worn valve ends permit pressure to equalize on piston and stop pump

lower end makes a flexible connection in the upper disk, so that any misalignment of the drill will not throw the grinding head out of alignment with the valve seat. A pin through the mandrel extended into slots in the sides of the hole through the disk provides the drive connection. A spring over the mandrel maintains tension between the drill and grinding head. A piece of No. 0 grinding cloth cut in a circle the size of the grinding head completes the job. Four tabs left on the cloth 90 deg apart fold up over the edges of the lower disk and are clamped between the two disks to hold the cloth in place. In the bottom disk a short round stub fits into the center hole of the valve seat and serves to guide the grinding head.

Valve seats may work loose and badly wear the threads. If new valve seats are not readily available they may be made tight, as in Fig. 8. The valve seat is first drilled and tapped for four setscrews. Then two small holes are bored through near the top and bottom of the seat threads for the ends of a piece of twine. After passing the twine through the top hole it is pulled against a knot in its end and wound tightly into the threads in the seat. Its free end is put through the hole in the bottom of the seat and knotted. The seat is then screwed down tightly and the setscrews tightened to hold it there.

Worn packing and scored and worn cylinder liners permit large leakage by the piston, thus reducing pump capacity. To remedy this renew the liner and the packing. If a new liner is not readily available carefully remove the old one and rebore it in a lathe. Liners may be rebored in place with a hand boring tool.

On the steam end of direct-acting pumps most common troubles are worn valves, piston rings, and cylinders, short stroking, piston hitting cylinder head, pump stopping on dead center.

STEAM-END MAINTENANCE

When steam valves wear down in the seats, their corners tend to wear round so that the valves no longer lap the admission ports. Steam then leaks to both sides of the piston at the same time and equalizes the pressure on it. Fig. 10. Renew the valves and remove the ridges from the valve seat to cure this trouble. The effects of these shoulders can be eliminated by cutting a groove in the seat just beyond the limit of valve travel.

PISTON-RING WEAR

Lack of lubrication and long service also cause the piston rings to wear the steam-cylinder walls. If the walls are not counterbored at the ends, or if the pump operates short stroking for a long time, shoulders develop in the cylinder at the end of piston travel. These shoulders may result in unnecessary wear of the rings and their grooves, because the rings are continually closing and opening when they hit the shoulder at the end of piston travel. New rings cannot be properly fitted without first removing the shoulders.

If the bushing around the piston rod in the stuffing box is worn, then the piston rides low in the cylinder except at its ends, where it is lifted by the shoulders. This action causes the piston rod to be higher in the stuffing box at the end of the stroke than at the center of travel and is a common cause of steam blowing through the packing at the end of each stroke. Another cause of steam blowing through the packing is a bent or a worn piston rod. To remedy: remove cause of trouble.

Short-stroking, a common fault with direct-acting steam pumps, may result from the piston rings striking shoulders worn at the end of the cylinder, as already mentioned, lack of proper lubrication on the steam end, excessively tight packing on both the steam and the water ends of the pump, excessive cushioning in the steam cylinder at the end of the stroke, excessive discharge pressure on the water end, and improperly adjusted valves. If the water pistons have compression packing and this is compressed into the cylinders too tightly it can, when combined with too tight packing on the piston rods, increase load on the pump to a point where it will short-stroke. Proper setting of the valves will depend on their type and should be done according to the pump manufacturer's instructions.

When the piston strikes the cylinder head it is generally caused by improper adjustment of the cushioning valve, on pumps equipped with them. On pumps that do not have cushioning valves, improper steam-valve adjustment can make the piston strike the cylinder head. Adjust the slide-valve rod-adjusting nuts until there is just enough play for the piston to make a full stroke without striking the head.

Rotary Pumps

PRACTICALLY EVERY KIND of mechanism has been used for a rotary pump. These designs include spur, helical and herringbone gears; external-internal gears, screws, swinging vanes; two-, three- and special-lobe or cam arrangements; sliding-vanes, cams and pistons, rotary pistons, universal joints, rubber tubes compressed by rotating cams and other designs. Each type probably has faults peculiar to its design, but many troubles are common to them all.

A rotary pump, like a reciprocating unit, operates with a positive-discharge, so that if its discharge is closed excessive pressure will develop. In the gear pump, Fig. 1, the gears operate with close clearances in their casing and in their mesh at *C*. Therefore, as the gears rotate, liquid trapped between the teeth and casing is forced out the discharge. In the internal-gear pump, Fig. 2, the external gear teeth *T* attach to the rotor and the internal gear *G* rotates freely on a fixed trunnion, with the crescent *C* acting as a seal between the suction and discharge.

Fig. 3 shows a sliding-vane pump. In this design the radial vanes are free to slide in the rotor. In the swinging-vane design, Fig. 4, the rotor consists of four arms that support swinging vanes. Crescent *C* is solid between intake and discharge and, with the rotor arms, acts as a seal between the two. In all these designs the liquid is trapped between the gear teeth or vanes and carried around to the discharge.

WEAR OF ROTATING PARTS

A large part of what has been said about troubles and how to avoid them in centrifugal pumps, pages 85 to 89, applies with equal force to rotary pumps. Other troubles are tabulated in the troubleshooter's guide, page 93. Wear of rotating parts and casing insides constitutes one of the most serious troubles with rotary pumps and everything possible should be done to prevent it. Slight misalignment of the pump with its driver may cause vibration and excessive wear. Support suction and discharge piping so that it does not put a strain on the pump casing and cause internal rubbing. Air leaks in the suction line or air traps reduce rotary-pump capacity just as they do in a centrifugal. Solid material may go through a centrifugal pump without harm, but not in a rotary pump. Its suction pipe must have a strainer unless the liquid will always be clean.

When there is a valve in the discharge line that might be closed by mistake, provide the pump with a pressure-relief valve and make sure that it is set for rated pump pressure or less.

Check the packing frequently to make sure that it performs properly. Dry packing, or packing that is too tight, scores the shaft as it does in a centrifugal pump. In addition, tight dry packing uses a lot of power, especially in pumps that have four packings. When repacking, remove all the old packing and clean the stuffing box.

Rotary pumps normally operate at slow speeds and in no case should they be run at more than 10% above rated speed, and this only when handling low-viscosity liquids. As the viscosity of liquids increases, pump speed must be reduced and horsepower increased. For example, taking speed and power for pumping water or light oil as 100%, then for liquids with a viscosity of from 2000 to 3000 ssu, the pump speed must be decreased to 60% and the power will double.

If the pump speed is too high the liquid cannot flow into the pump as fast as it is discharged. A high vacuum may develop at the intake, which will cause the pump to be noisy in its operation. Noisy operation also results from fluid being trapped in the gears of gear pumps, as at *D*, Fig. 1. When this occurs it generally places heavy loads on the bearings and may overheat them.

NOISY-OPERATION CAUSES

Other causes of noisy operation include excessive suction head which prevents sufficient liquid flowing into the pump. This may result from the pump being located too high above the liquid level, combined with the head losses in the suction pipe. It may also result from operating the pump at too high a speed for the viscosity of the liquid, from a clogged strainer or foot valve.

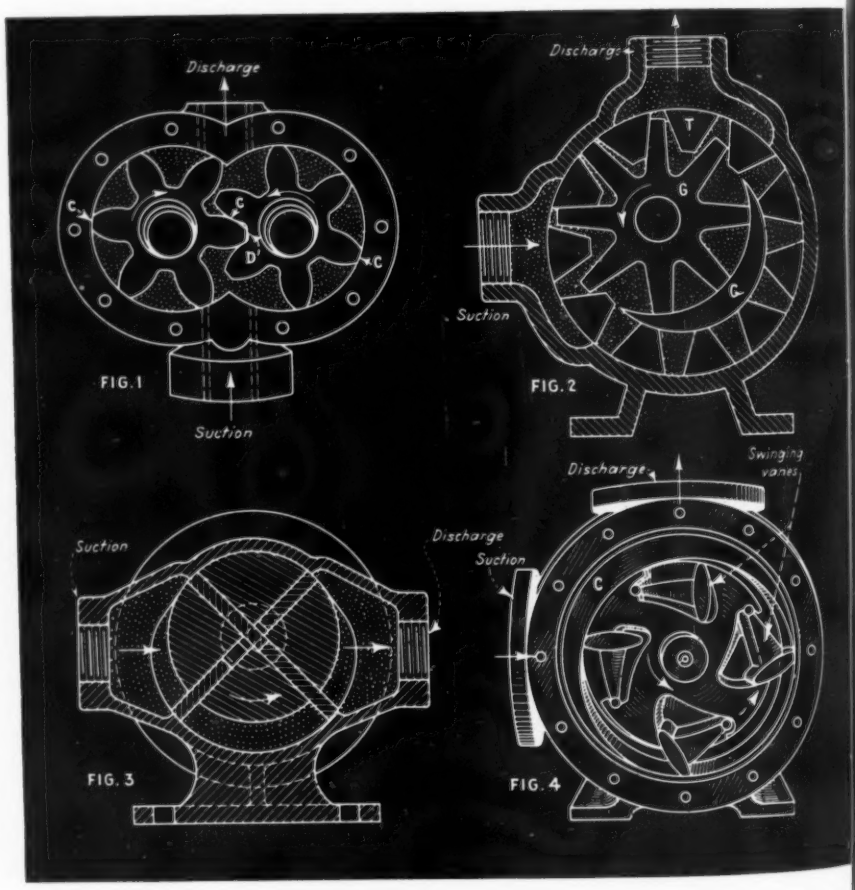
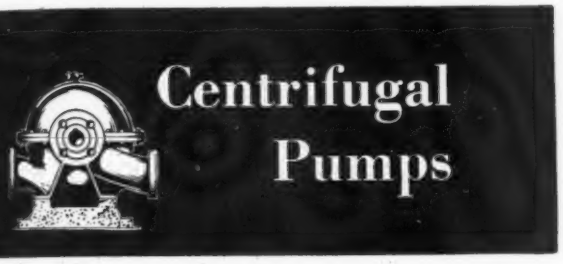


Fig. 1—Cross-section through simple spur-gear rotary pump. Fig. 2—In this internal-gear pump the crescent acts as a seal between suction and discharge. Fig. 3—Sliding-vane rotary pump. Fig. 4—In this pump four arms support swinging vanes that form the pumping elements

Pump Trouble-Shooting Guide

IF TROUBLE IS EXPERIENCED with any pump, make sure that conditions are such that the pump can discharge if it is in good working order. Too frequently pumps have been reported out of order only to find the discharge valve closed, the discharge pipe frozen or the water running out of the storage tank through a leak in the distribution system, as fast as it is pumped in. Too much emphasis cannot be placed upon these three simple things because, strange as it may seem, they are frequent causes of supposed pump trouble.



PUMP FAILS TO DISCHARGE

Pump not properly primed: Reprime the pump, opening all vents until steady unbroken stream of water flows out. **Discharge head too high:** Check with correct-reading vacuum and pressure gages connected into the suction and discharge line at the pump. **Wrong direction of rotation:** Check arrow on casing.

Impeller or suction pipe clogged: Examine carefully for solids or other foreign matter. **Suction lift too high:** When handling cold water total lift should not exceed 15 ft, and in any case should not exceed 66% of total head. **Strainer or suction line clogged:** Examine strainer and inside of suction line. **Foot valve stuck:** Suction pipe may screw so far into valve as to hold it on its seat.

Speed too low: Check speed with tachometer or speed counter and compare with speed given on pump nameplate. **Air pockets in suction line:** Line may have an upward loop or high point where air collects. **Not enough suction head for hot water or volatile liquids:** Water at 212 F requires at least 15 ft suction head at impeller eye.

NOT UP TO CAPACITY AND PRESSURE

Pumps not properly primed: See Pump Fails to Discharge. **Stuffing-box packing worn, pump improperly packed, or packing too loose:** Repack stuffing box or tighten gland on packing. Caution: Don't draw packing too tight. **Speed too low:** See same item above. **Discharge head higher than that for which the pump was selected:** Check head losses in piping system. **Suction lift too high. Suction screen partly clogged. Foot valve or intake of suction pipe may not have sufficient submergence:** Vortices form in the suction well through which air enters the suction line.

Foot valve clogged, not working properly or too small. Air pocket in suction line or in pump casing; air or gas in liquid: Air leaks through joints or holes in suction line or through packing around valve stems, or enters suction pipe from suction well because entering water falls into the well or flows in too near intake end of suction pipe.

Impeller clogged or too small in diameter, driven in reverse direction, reversed on its shaft. Sealing rings on impeller and casing worn: Check clearance and if excessive, renew rings or build up old ones by welding or metal-spray process and machine to correct size. **Impeller damaged. Shaft sleeve worn or loose. Packing worn, not of correct grade, improperly installed, or too loose. Sealing-water connection to lantern ring stopped. Lantern ring in wrong location.**

Damaged or defective gasket between top and bottom halves of casing on split-case pumps: Renew gasket. **Liquid vaporizes:** If hot or volatile liquids are being pumped there may not be sufficient suction head to prevent vaporizing part of the liquid.

PUMPS START AND THEN STOP PUMPING

Causes practically the same as those for low capacity and pressure given under the preceding heading.

PUMP TAKES TOO MUCH POWER

Speed too high: Speed of power unit too high. Driving unit connected to pump to give too high speed. **Head too low so that pump delivers too much liquid:** Reduce pump speed or reduce impeller diameter. **Liquid pumped heavier than water:** Check specific gravity and viscosity of liquid. **Pump rotating in wrong direction. Impeller and casing sealing rings rubbing:** Worn or improperly adjusted thrust bearing, impeller loose on shaft. **Packing in stuffing boxes drawn up too tightly. Bent shaft.**

VIBRATION AND NOISY OPERATION

Misalignment of pump with its driver. Misalignment caused by piping expansion strains or by pump expansion: Be sure piping and pump are in correct alignment when hot. **Misalignment caused by wear in pump bearings:** Renew bearings. **Impeller-eye diameter too small for hot or volatile liquid. Pump casing distorted:** Caused by the effects of temperature change, unsymmetrical casing design or pipe strains. **Rotor distorted by high temperature:** If possible warm pump with the rotor turning slowly. **Rotor distorted:** Face of shaft nut and impeller hub faces not in line. **Pump or driver rotor out of balance:** Uncouple drive and see if it runs at full speed without vibration. Then connect pump and check for unbalance vibration again. Impellers may be in good dynamic balance, but if they are slightly loose on the shaft the key will force them enough to one side to throw the rotor out of balance. **Pump and its driver bearings worn:** Check bearings to make sure they are in reasonably good condition.

Piping not properly supported: Support piping so that it cannot vibrate and put a strain on the pump. **Foundation not sufficiently rigid for the pump. Excessive wear of hydraulic thrust balancing device:** Replace worn parts. **Wrong impeller assembly:** Multi-stage rotor may be incorrectly assembled so that the first-stage impeller with over-

size eye for hot liquid is not in the first stage. **Internal parts rubbing:** Check diaphragms, shaft sleeves, shaft nuts, stuffing-box bushings, sealing rings and balancing device for indications of rubbing. **Operating in critical-speed range:** If speed has been increased, such as with turbine-driven pumps, it may have brought rotor shaft into critical-speed range. **Waterways through pump clogged:** Look for scale or other solid matter from the piping system. **Insufficient suction head for temperature of liquid pumped.**

Liquid velocity too high: May be greater than intended when pump was designed. **Hydraulic balancing device does not give perfect axial balance:** This overloads thrust bearing and causes wear and noisy operation.

Cavitation: Suction lift too high or improperly designed impellers. **Bent shaft. Flexible coupling damaged or not working properly. Vibration or pulsations in piping system.**

MISCELLANEOUS

Coupling pins or bushing wear too fast: Pump out of alignment with its driver. Coupling not properly lubricated or may be overloaded; halves of coupling too close together; coupling exposed to abrasive dusts or corrosive atmospheric conditions. **Bearing runs hot:** Worn thrust bearing or automatic hydraulic thrust-balancing device worn or not working properly; bent shaft; too much lubricant in anti-friction bearings; insufficient or improper lubricant in sleeve bearings; cooling water not turned on or its flow greatly restricted in water-cooled bearings.

Motor runs hot: Voltage low. Speed too high because of high frequency, if alternating current; or weak field or high voltage if direct current. Driving-motor speed too high for pump or connected to pump to give too high speed.

Power required to drive a centrifugal pump varies as the cube of its speed, as a result a small increase in speed only is needed to overload its driving motor, particularly if the motor would be nearly loaded when driving the pumps at normal speed. For example, at 110% rated speed a centrifugal pump requires 32% more power to drive it than at normal speed, which may easily overload its driving motor.

Rotary Pumps

FAILS TO DISCHARGE

Many of the items listed under centrifugal pumps apply to rotary pumps. **Pumps not primed:** See that pump casing and suction line are filled with liquid. **Suction lift too high:** Total dynamic suction lift should not exceed 25 ft, but should be 20 ft or less. Check with a vacuum gage connected near the pump suction nozzle. **Wrong direction of rotation:** Many rotary pumps will operate in either direction, but must be correctly connected for the direction in which they are driven. **Clogged suction line or suction strainer. Air pockets in suction line due to faulty design or installation.**

NOT UP TO CAPACITY

Air leaks into suction pipe: End of pipe not submerged deeply enough in the liquid, or air leaks through joints in suction line or through valve stem packing. **Packing around drive shaft worn or too loose:** If lantern ring is used in packing, sealing-fluid passages may be stopped and fluid is not getting into lantern ring. **End of suction line too close to bottom of supply tank. Foot valve too small, stuck or not working properly. Clearance between pump parts may be worn:** This permits excessive leakage. If this cannot be remedied by removing a gasket to allow pump heads and working parts to seal more closely, then renew pump parts. **Liquid volatile:** Liquid handled vaporizes or breaks in the suction line at a certain suction lift.

DISCHARGE BELOW RATED PUMP CAPACITY

Air leaks into suction line. Suction well level too low. Viscosity of liquid pumped varies. Excessive suction lift. Suction head too low: Not enough suction head for hot or volatile liquid. **Viscosity of liquid too high:** Increase temperature of liquid, or slow down pump. **Pump in poor mechanical condition:** Overhaul pump and repair or renew parts where necessary.

PUMP WORKS THEN STOPS PUMPING

Suction line faults or air and gas in the liquid: Many of the causes under "Fails to Discharge" apply here.

Not Enough Pressure: Normally a rotary pump in good condition will build up an excessive presure unless equipped with a bypass valve, but because of poor mechanical condition of the pump its clearance may be so badly worn or its packing so defective that the pump can operate against a closed discharge without opening the bypass. Bypass-valve loading set too low. Valve stuck partly open.

PUMP TAKES TOO MUCH POWER

Speed of power unit too high or liquid heavier or more viscous than specified for the pump: Reduce speed of pump or reduce viscosity of liquid by heating. **Obstruction in discharge line makes pump operate above rated pressure:** Check head of pump against what normal head should be. Don't forget to include pipe and fitting friction in the normal head. **Stuffing-box packings too tight. Shaft bent:** Makes rotating elements bind and wear excessively. **Bearing too tight. Pipe connections distort pump casing:** This causes internal rotating parts to bind. **Misalignment of pump and driver. Poor fit of working parts:** Makes them bind and wear excessively. **Rotating elements rub casing:** Check inside of casing for rubbing and wear.

NOISE AND VIBRATION

Air in liquid pumped. Speed too high, especially when handling thick, volatile, or hot liquids. Suction lift too high: Prevents pump from filling with liquid. This action causes voids in the liquid stream that fill with vapor and gas. When these bubbles reach regions of elevated pressure they suddenly collapse and deliver a hammer blow to the pump rotors. **Worn parts:** Gears, cams, or other parts badly worn.

POWER-DRIVEN Reciprocating Pumps

FAILS TO DISCHARGE

Pump not properly primed: Many of the items under this heading for centrifugal and rotary pumps apply also to reciprocating pumps. These pumps, however, will discharge against excessive heads and in either direction of rotation.

Suction lift too high: Should not exceed 22 ft. Check with vacuum gages. **Suction valves stuck:** See that valves work freely and are seating properly. **Suction valves completely worn away. Valve seats in bad condition. Not enough suction head for hot water or volatile liquids:** Measure the suction head at the pump with a pressure gage and check against table of required heads for hot water. Water at 212 F requires at least a 15-ft suction head at the pump, the same as for a centrifugal pump.

NOT UP TO CAPACITY

Pump not properly primed: Many of the items under this heading for centrifugal and rotary pumps apply to reciprocating types. **Speed too low:** Discharge rate of these pumps is practically proportional to speed. **Foreign matter prevents valves seating properly. Not enough suction head for hot water or volatile liquids. Valves worn or warped:** Do not seat properly. **Valve spring broken. Piston rod or plunger packing worn:** Permits air leakage into cylinders.

Piston rods or plungers scored and worn: True-up rods or plungers or install new ones and repack. **Cylinder liners and piston packing worn, permitting leakage around piston:** Install new liners if available or pull out old ones and rebore. Renew packing on piston.

PUMP POUNDS AND VIBRATES

Air in liquid: Liquid level low in suction well, turbulence in suction well, inflow in suction well too close to suction pipe, inflow falls into suction well, leaky suction line, leaky packing around valves in suction line or leaky packing around piston rods or plungers. **Suction lift too high:** Should not exceed 22 ft. **Excessive speed:** May cause the suction pressure to go very low on the suction stroke and high on the discharge stroke. Reduce speed.

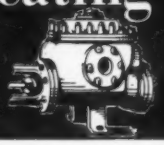
Speed too high for viscous liquids: Reduce pump speed or viscosity of liquid. **Plungers too heavy for speed of pump:** Requires a vacuum chamber or a priming tank on suction line or air chamber on discharge pipe. Vacuum chamber filled with air or air chamber or discharge filled with water. See Fig. 2 and 3, page 90. **Excessive head. Worn gears. Loose crank-pin. Loose crosshead pins. Loose crosshead. Loose bearings and worn bearings.**

PUMP TAKES TOO MUCH POWER

Speed too high: See *rotary pumps*. **Low voltage on motor drive. Head higher than rating on pump:** Check head with gages equipped with snubbers to make them practically dead beat. **Liquid heavier than anticipated:** Check viscosity and specific gravity. Viscosity of the liquid can probably be reduced by heating. **Packing too tight.**

DIRECT-ACTING

Reciprocating Pumps



For the items: "Pump Fails to Discharge" and "Not Up to Capacity," see power-driven pumps. Direct-acting steam pumps cannot be overloaded like power-driven designs, because the maximum pressure that they can develop in the water end depends upon the maximum available steam pressure in the steam cylinder. If the head is excessive on the water end or the packing on the piston rods or plungers is too tight, or excessive friction develops in other parts of the pump, it will stop.

Faults on the water ends of these pumps and the remedies are practically the same as for power-driven pumps as outlined above.

SHORT-STROKING:

Not properly lubricated. Piston rings strike shoulders worn at end of cylinder: Remove shoulder by grinding or in a boring mill and replace piston rings if necessary.

Packing too tight: Packing on both the steam and water ends of the pump should be only tight enough to reduce leakage to a reasonable amount. **Excessive cushioning in steam cylinder:** Adjust cushioning valve to give full stroke. **Excessive discharge pressure on the water end. Steam valves not properly set:** Set the valves according to the instructions supplied by the pump manufacturer.

PISTONS JUMP AT BEGINNING OF STROKE

Air trapped somewhere in water end of pump: This is most likely to occur on pumps operating against a high suction lift, or results from allowing the pump to race when starting. Operate the pump slowly for a while, with the air vents open. Excessive suction lift prevents pump cylinder from properly filling with water, before discharge stroke begins. **Pump operating at too high speed for the viscosity of the liquid handled. Pump not properly primed. Not sufficient suction head for the temperature of the water being pumped:** Reduce the speed of the pump, increase the suction head, or reduce the liquid temperature.

PISTON STRIKES CYLINDER HEAD

Cushion valve between admission and exhaust ports not properly adjusted or slide valve adjusting nut not properly set: To adjust the cushion valve run the pump without water load, open the cushion valve until piston strikes the head. If the piston strikes too hard adjust the play in the slide valve rod and do the same if the piston does not strike. Place the pump under load and close the cushion valve until the piston stops striking the cylinder head. If there are no cushioning valves on the pump, set the slide-valve rod-adjusting nuts to where there is just enough play to permit the pump to make a full stroke without the piston striking the cylinder head in either direction of travel.

PUMP STOPS ON DEAD CENTER

Slide valve worn: Ends of slide valve worn so that when valve is in center position steam is admitted to both ends of the cylinder to equalize the pressure on the piston. Renew the valve or replace the worn ends. **Valves improperly set:** Reset valves according to manufacturer's instructions.

STEAM BLOWS BY PACKING AT STROKE END

Shoulders worn in cylinders near end of stroke: When piston hits these shoulders they lift the piston rod in the packing. Remove the shoulders by grinding or in a boring machine. These shoulders can be prevented from forming by counterboring the ends of the cylinder back to within normal piston travel and making sure that the pump does not short stroke. Bent or worn piston rod: Repair or replace the rod. Piston rods must be smooth and true along that part

which runs in the packing. Rods sometimes wear smaller in the center of their travel. Such rods tend to expand the packing at the end of travel and prevent it from making proper clearance with the rods at the center of travel; as a result steam blows through at the middle of the stroke.

PUMP WILL NOT START

Motor at fault: On alternating-current motors trouble may result from low voltage, an open phase, bearings worn to let rotor rub on stator, an opening in rotor circuit of wound-rotor motor, loose connections between end rings and rotor bars of squirrel-cage motor, or short circuit or open circuit in stator windings. **Fuses or circuit breaker open or overload relays tripped. Pump sand-locked:** Try loosening with a stillson wrench. **Pump frozen:** May happen in cold weather. **Crooked well:** Check well for plumb. **Faulty thrust bearing:** Thrust bearing worn or improperly adjusted, permitting the impellers to rub their bowls. **Packing too tight.**

PUMP FAILS TO DISCHARGE

Pump not primed: Well water level dropped below the bottom impeller. Prime pump by running water into the well or by an ejector or other priming device on the water column. **Pump head too great:** Water level in well lower than anticipated. Discharge line long and too small. **Pump speed too low:** Power supply voltage or frequency low or pump binding. **Pump shaft broken. Pump running in wrong direction:** Check with manufacturer's instructions. **Discharge valve closed or discharge head too high. Suction pipe, impeller or strainer clogged.** If the well is driven in sand the strainer may easily become so badly clogged as to prevent water flowing into the pump.

PUMP CAPACITY OR PRESSURE LOW

Speed too low: Voltage or frequency or both low. **Discharge head too great for the pump. Air liberated from the water:** When lowest impeller is above water level, air may leak into suction line. **Partly clogged impeller strainer or suction line. Water level drops in well to where suction lift is excessive. Valve in discharge line partly closed. Impeller clearance worn excessively. Pressure gage or discharge-measuring device not properly calibrated. Impellers raised too high in their bowls.**

PUMP USES EXCESSIVE POWER

Speed too high. Frequency too high. Discharge head too high. Pump binding: Pump shaft bent crooked throwing pump-shaft bearing out of line, or pump shaft sections not properly threaded together. Impellers running too high or low and rubbing on their bowls. **Pump and motor out of alignment. Sand in the water. Bearing improperly lubricated. Packing too tight. Oil too heavy in inclosed pump shaft:** Oil used to lubricate enclosed pump-shaft bearings should be light, not over 100 to 150 ssu viscosity at temperature of water pumped.

PUMP VIBRATES

Out of balance or misaligned: Motor or coupling not properly balanced or out of alignment with pump. Worn bearings, bent pump shaft, or crooked well. Impellers out of balance because of foreign matter lodged in them. **Air or gas in the water. Excessive wear:** Sand or other abrasives or corrosives in the water. Lack of proper lubrication. Pump shaft out of line, or bent, throwing bearing out of alignment.

On new installations be sure that the pump is free to turn before connecting the motor to the line. On old installations if a fuse blows or a circuit breaker opens make sure that the pump turns freely before trying to start it. Many deepwell pumps operate under severe conditions and many things can happen to prevent them from turning.

WEARS RAPIDLY

Scored, badly worn, bent piston rod or impeller shaft sleeve: Repair or renew piston rod or shaft sleeve. **Centrifugal pump out of line with its driver:** Correct misalignment. **Piston rod or shaft running out of center in the stuffing box because of worn cylinder, piston or bearings:** Make the necessary repairs to correct this defect. Experience shows that shaft or piston rod must run true to within 0.002 in. to avoid packing trouble. **Excessive clearance between bushing in bottom of stuffing box and piston rod or impeller shaft:** Check stuffing box to make sure that it is concentric with the piston rod or shaft and renew bushing in bottom of stuffing box. Bushing should make a close running fit on rod or shaft.

Packing not suited to the application or not properly installed: Check with packing manufacturer for correct grade and install according to instructions. **Shoulders worn in cylinder cause piston and rod to lift at end of stroke.** Put pump in good working condition.

Pressure or temperature or both excessive for the packing used: Change to correct packing. **Liquid pumped dissolves lubricant out of the packing. Fluid for liquid seal contains abrasive solids:** Connect lantern ring to clean-fluid supply to backwash the packing.

Lantern ring not located at sealing-fluid connection: Stuffing-box gland too tight or gland pulled out of line with piston rod or shaft. If stuffing box is properly packed with correct grade and size of packing, setting-up the gland nuts finger-tight should be sufficient for most applications. **No leakage through stuffing box:** A small amount of leakage is necessary through the packing to serve as a lubricant, if packing is to have a long life.

SCORED PISTON ROD OR IMPELLER SHAFT

Packing too tight, not of correct grade or improperly installed. Lack of sufficient leakage to lubricate the rod or shaft. Temperature of liquid too high for the packing: Check with packing manufacturer and use water-cooled stuffing box if necessary. **Packing burned to a hard surface.** Renew packing and make sure that it is not operated too tight, and that a small amount of leakage is permitted to lubricate and cool the packing. **Sealing water to lantern ring contains abrasive solids. Gland tightened unevenly and rubbing on rod or shaft.**

WARTIME POWER CLINIC

Practical ways to create emergency capacity. Cures for overloads, breakdowns, short-handed staffs, lack of spare parts, etc. Contributions invited at regular rates

Converts Flywheel Into Larger Pulley

LARGE PULLEYS are hard to get these days, so some other plant may be able to use this stunt to convert a flywheel into an amply large pulley for the job.

The steam-driven air compressor at the plant of the Coplay Cement Company, Coplay, Pa., was often too short of steam to deliver its rated air capacity. A motor was available for drive (with steam side of compressor disconnected) but the unit's flywheel was too narrow for adequate belt width and somewhat too small in diameter for a correctly designed belt drive.

According to William J Jones, Jr, plant superintendent, the flywheel surface was encased in a steel shell much wider and somewhat larger in diameter than the flywheel rim. This was attached to the rim by spacer bars welded as shown. The V-belts (Gates Vulco Ropes) bear flat on the shell but run in grooves on the motor sheave. See Fig. 1 and 2 on this page.

Fig. 1—V-belts from motor sheave run to smooth shell welded to space bars

Wooden Blocks Extend Brush Life

WHEN CARBON OR GRAPHITE brushes on commutators and sliprings are worn so short that their holder springs no longer apply proper pressure, they should be replaced. However, in these turbulent times new brushes may not be readily available—as in my case. To extend the brush life, I cut short blocks of wood that fit into the holders on top of the brushes, see sketch, p 100. This arrangement made possible several months of additional brush service, and

(CONTINUED ON PAGE 100)

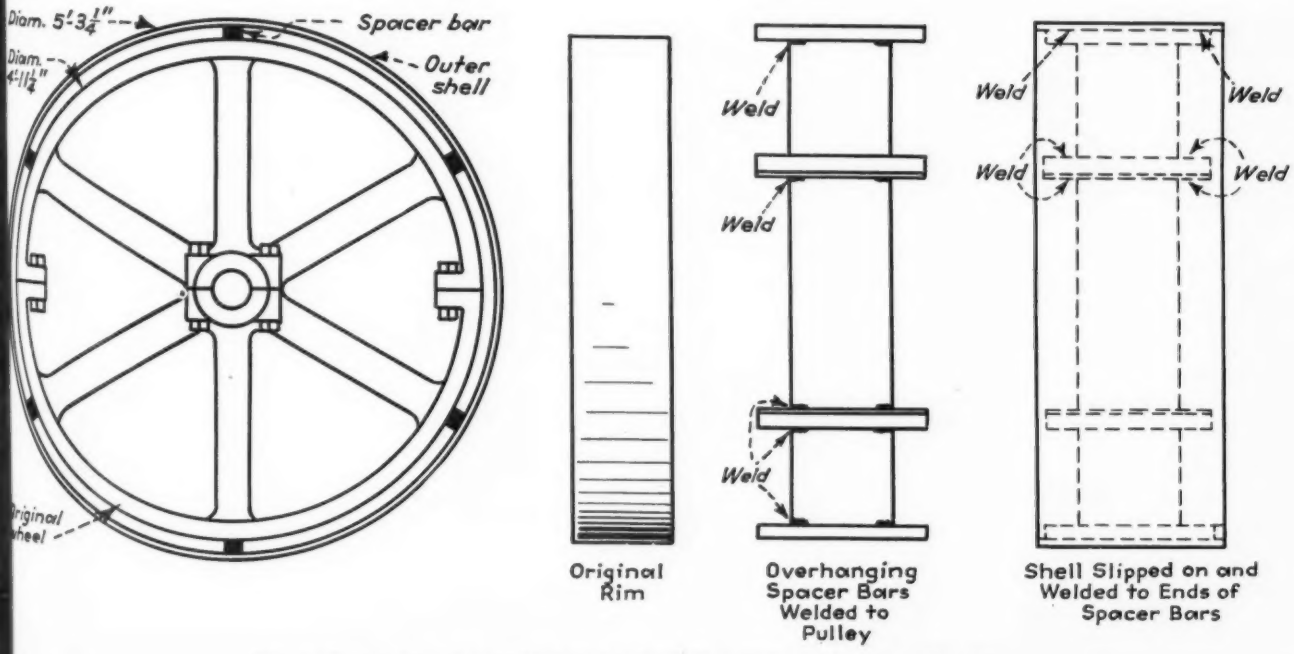
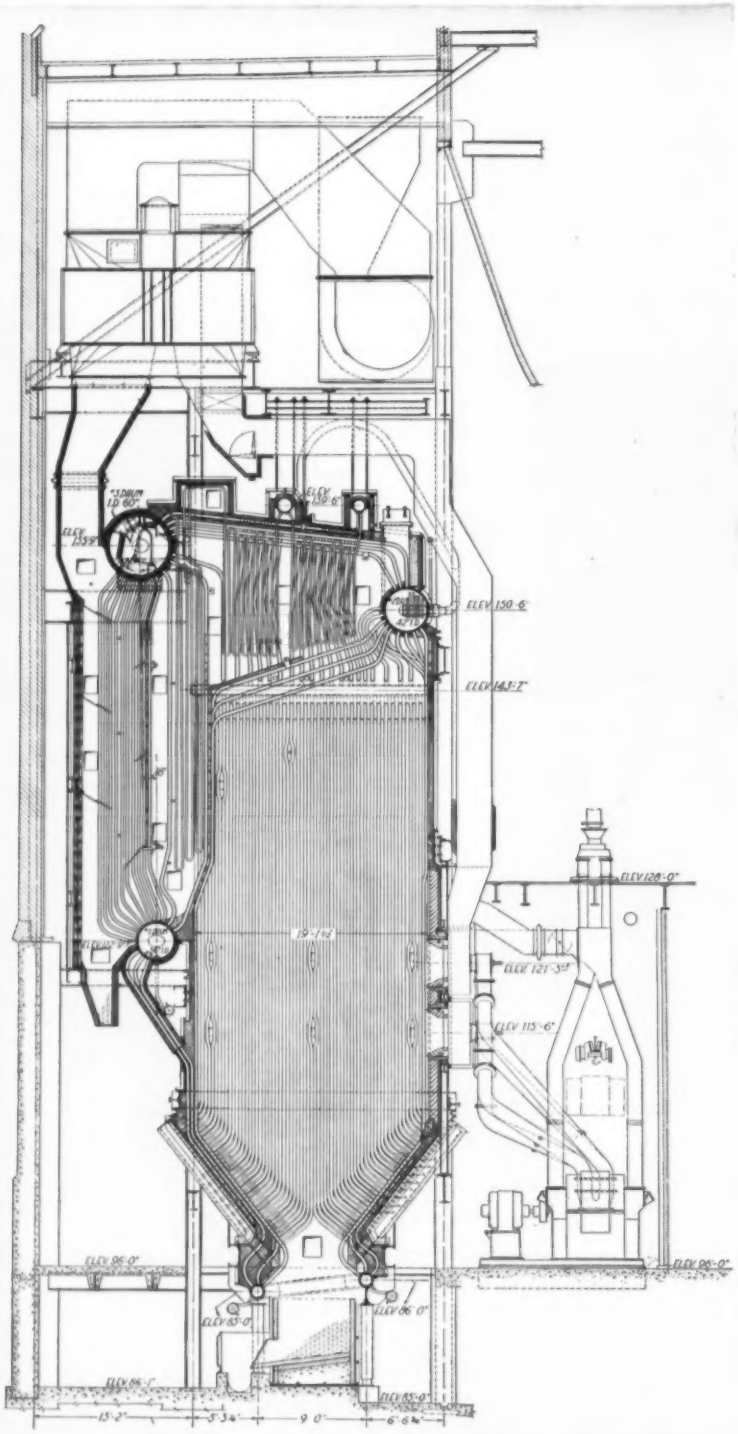


Fig. 2—Spacer bars first welded to flywheel, then ends welded to steel shell

The Large Central Station Plants



Here are two of the most recent RILEY Central Station Units

Within recent years, the large central station plants have followed the lead of the country's outstanding industrial plants by swinging to Riley Steam Generating Units, including Riley Fuel Burning Equipment. Many of the country's outstanding public utility plants are now operating Riley Units. The list of recent installations on the accompanying page clearly indicates this trend to Riley.

Riley's tremendous progress in the boiler industry can be attributed only to the outstanding performance of Riley Units—their absolute dependability; continuity of operation; low maintenance; high efficiency. To the fact that guaranteed performance is invariably exceeded by actual operating results. To the fact that the Purchaser can rely on Riley to give them more than their money's worth.

Layouts of two representative installations are shown here. Both of these units are fired by Riley Pulverizers, and are of the dry bottom type. In one case the last previous installation was of the wet bottom type. There appears to be a definite trend from wet bottom furnaces to the dry bottom type. In quite a number of cases, companies who had previously installed wet bottom units have installed dry bottom furnaces for their latest installations.

Large Iowa Public Utility.
Pulverized Coal Fired Dry Bottom Type.
Previous Unit Wet Bottom Type.

300,000 lbs. of Steam per hour.
975 lbs. Pressure—825°F Temperature.
85.3% efficiency at 250,000 lbs./hr.
Unit fired with Riley Atrita Pulverizers.

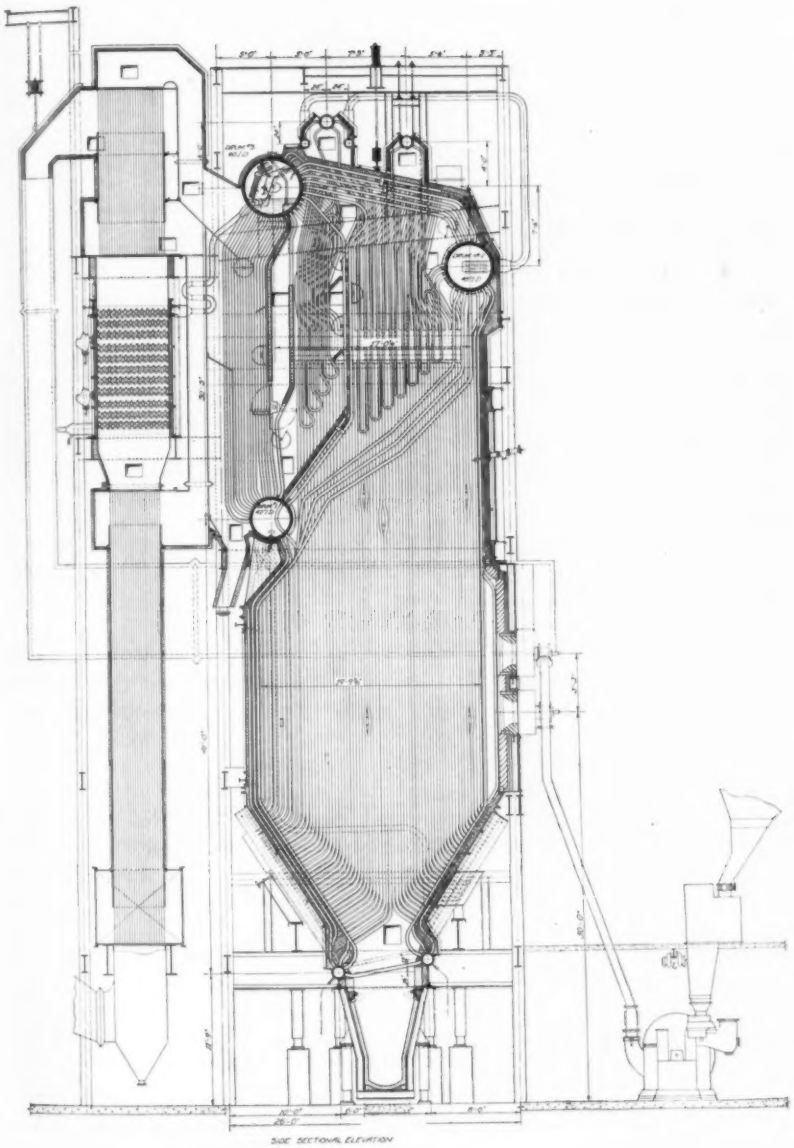
RILEY

STOKER CORPORATION, WORCESTER, MASS.

Boston New York Philadelphia Pittsburgh Baltimore Buffalo Cleveland Detroit Chicago St. Louis Cincinnati
St. Paul Kansas City Denver Seattle Portland Los Angeles Houston New Orleans Atlanta Memphis Richmond

It will pay you to visit modern Riley Installations

have also *swung* to Riley Units



Large Penn Public Utility—Dry Bottom Pulverized Coal Fired Unit.

300,000 lbs./hr.—975 lbs. Pressure—900°F Temperature.
88.5% efficiency at 275,000 lbs./hr.—Unit fired with Riley Atrita Pulverizers.

A few recent Public Utility Installations of Riley Steam Generating Units

Union Electric Co. of Ill., Venice
2—400,000 lbs. /hr.–1,000 lbs.–915°F
Carolina Power & Light Co., Cape Fear
2—330,000 lbs./hr.–1025 lbs.–905°F
Commonwealth & Southern Corp.
Central Ill. Light Co., Peoria
1—375,000 lbs./hr.–900 lbs.–900°F
1—300,000 lbs./hr.–900 lbs.–875°F
Florida Power & Light, Ft. Lauderdale
1—300,000 lbs./hr.–1025 lbs.–908°F
Houston Lighting & Power Co., Gable St.
1—400,000 lbs./hr.–1,000 lbs.–905°F
1—250,000 lbs./hr.–975 lbs.–910°F
Iowa-Illinois Gas & Electric Co., Davenport
1—300,000 lbs./hr.–975 lbs.–825°F
Penn Edison Co., Williamsburg
1—300,000 lbs./hr.–975 lbs.–900°F
Commonwealth & Southern Corp.
Southern Ind. Gas & Electric Co., Evansville
1—225,000 lbs./hr.–900 lbs.–900°F
City of Los Angeles, Cal., Harbor Sta.
2—675,000 lbs./hr.–1091 lbs.–915°F
Union Electric Co. of Mo., Ashley St.
2—300,000 lbs./hr.–220 lbs.–520°F
City of Taunton, Mass.
1—170,000 lbs./hr.–1,000 lbs.–825°F
Natrona Light & Power Co.
2—90,000 lbs./hr.–450 lbs.–700°F
Central Ohio Light & Power Co., Bluffton
2—60,000 lbs./hr.–490 lbs.–835°F
City of Austin, Minn.
1—100,000 lbs./hr.–450 lbs.–750°F
Otter Tail Power Co., Wahpeton
1—130,000 lbs./hr.–600 lbs.–825°F
Lynn Gas & Electric Co.
1—205,000 lbs./hr.–530 lbs.–775°F
Fort Bend Utilities
1—160,000 lbs./hr.–502 lbs.–750°F
Union Public Service Co., Canby
1—75,000 lbs./hr.–515 lbs.–825°F
Northwestern Public Service Co., Aberdeen
2—50,000 lbs./hr.–675 lbs.–830°F
Lake Superior District Power, Ashland
1—100,000 lbs./hr.–740 lbs.–555°F
City of Norwich, Conn.
1—75,000 lbs./hr.–725 lbs.–750°F
City of Columbus, Ohio
1—150,000 lbs./hr.–775 lbs.–750°F

A survey of your power plant by a consulting engineer will possibly show ways of making surprisingly large savings in power costs

COMPLETE STEAM GENERATING UNITS

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • FLUE GAS SCRUBBERS
ECONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS

before purchasing Boiler or Fuel Burning Equipment

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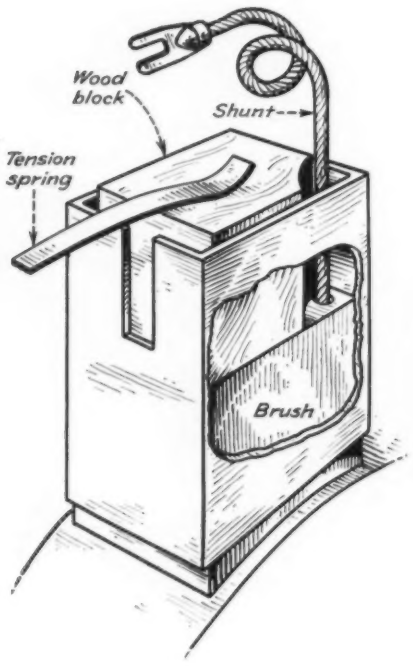


helped keep a badly needed motor running.

When doing a job like this, take care not to wear the brushes so short that the copper plating on their top ends comes in contact with the slipring or commutator. Sparking between the copper on the brushes and the surface of the ring or commutator may badly burn and score the latter. The blocks must be cut square to fit the end of the brushes and also must move freely in the brush holders.

Menard, Ill. GEORGE HOLMAN

Tamper-Proof Gate Latch

THE WAR HAS GIVEN new importance to fences, gates and locks. However, while a locked gate effectively keeps out trespassers, it is a nuisance to employees who must leave an enclosure in a hurry. The ordinary inside latch proves more convenient but without special protection it can generally be operated by poking fingers through the wire mesh.

To prevent this, the inside latch in the sketch is so housed by two mating pieces of 10-in. pipe that it cannot possibly be operated from the outside. These mating pieces have been made from a single short piece of 10-in. pipe, cut on the bias with an acetylene torch.

One piece of the pipe is welded to a plate attached to the swinging fence post, and this plate carries the latch. The matching piece of pipe is welded to another plate attached to the stationary fence post.

Method of operation can be seen in the sketch. Note that the gate swings in; for a gate swinging out, reverse direction of bias cut to allow the moving half to swing clear.

Tulsa, Okla. J. C. ALBRIGHT

Repairing Tubes, Tanks, Furnaces

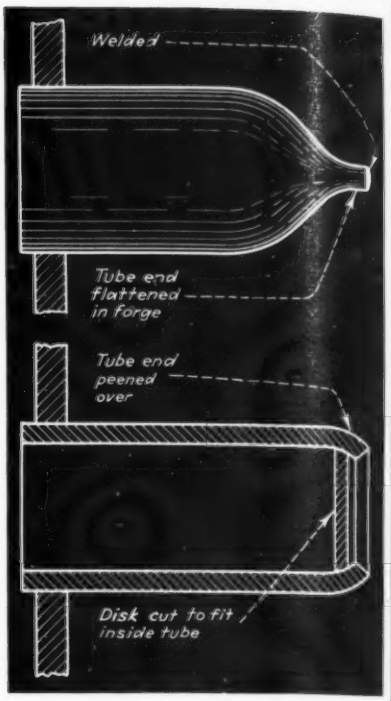
WARTIME EMERGENCIES bring to mind some of the depression-time troubles we all experienced. Perhaps the following solutions of five problems may now be applied in this greater emergency:

1. We had boiler tubes blistered and leaking badly, no spares on hand and none to be had for several reasons. Boilers had to be kept in service, so we solved the problem as shown in the accompanying sketch.

In place of the defective tubes, we cut several tube ends and formed dummies that stood up for months of severe service until we could obtain new tubes.

One type of dummy we merely heated in the forge and flattened at the end and seal welded. Another we peened over at the end, cutting a disk to plug the inside and welding around between the disk and peened end.

2. Another emergency job was a leaky drain tank kept in service by applying a half-inch coat of cement inside. This remedy can also be applied on the outside, in other cases, by first wrapping chicken wire around the tank.



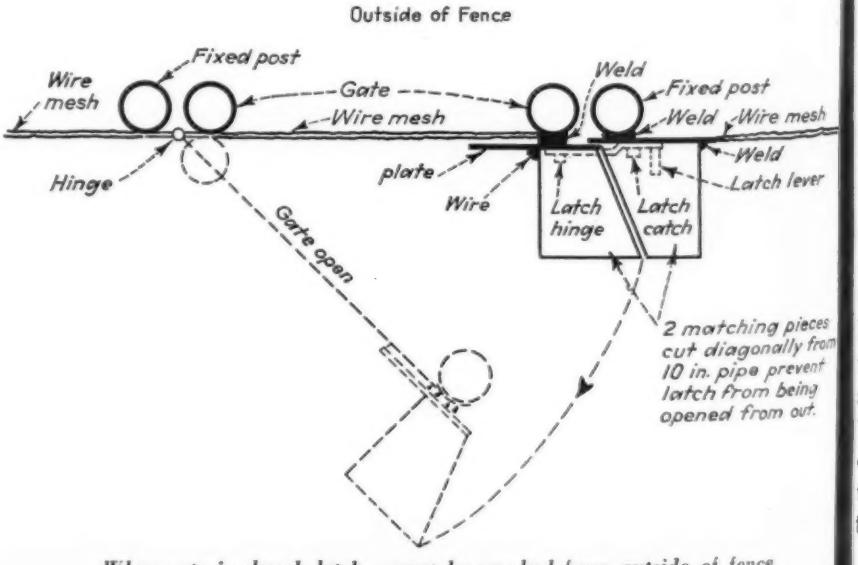
Dummy boiler tubes were flattened and welded, or sealed with a disk, peened over and welded

3. Another time we had to use boiler tubes too small for the tube holes in the locomotive-crane boiler. This problem we mastered by fitting strips of copper around the tube ends.

4. We made temporary repairs in furnace walls by shifting bricks from the lower-temperature zone to the high-temperature zone. Spalled bricks were turned with the good side facing in.

5. Cracks in the false floor of the furnace were sealed by laying a half-inch layer of sand on the floor. Furnace heat fused and sealed the cracks.

Kearny, N. J. G. MCNALLY



When gate is closed, latch cannot be reached from outside of fence

Mining—Number One War Industry

The mineral products of the earth are the prime necessities of war... and peace

THE SURFACE of the earth provided primitive man with the things he needed for his meager existence but civilization really began when he became curious about its interior. This curiosity has brought us a long way. For the earth has yielded — out of its deep recesses — all the raw materials of modern industry. And today, in the grueling race of production, our mining industry is providing the raw materials upon which depends our survival. Our mines and quarries must supply a long list of materials without which a successful war cannot be fought.

Take steel, for example. War without steel is inconceivable. Steel starts with iron ore, limestone and coke. These are products of mines and quarries. It takes power and heat to get these materials out of the ground, to refine them and to transport them to the point where processing begins. All the subsequent operations culminating in the steel ingot, shape or plate, and in moving the final product to the point of use require power and heat.

The major source of this power and heat is coal.

Production of a ton of steel, it has been stated, requires two tons of coal. Smelting of the pig iron alone, 60,000,000 tons in 1942, required the coking of some 75,000,000 tons of coal. Pig output is expected to rise to 68,000,000-70,000,000 tons in 1943, carrying coal consumption up to 85,000,000 tons. At the same time, output of steel ingots is expected to rise from 87,000,000 to 97,000,000 tons. Think what this means in terms of power and heat.

Another vital metal is copper. Modern armies need copper. This point is dramatically illustrated in a recent memorandum by Robert P. Patterson, Under Secretary of War, in announcing the release of 4,000 men from military service to return to the mines and increase copper production. "In a single minute of combat", Mr. Patterson declared, "a flight of 50 fighter planes shoots away 7 tons of copper. A 37-mm. anti-aircraft gun uses up a ton of copper every twenty minutes it is in operation. Six hundred pounds of copper go into every medium tank, and a ton into the engines and airframe of a Flying Fortress. The Signal Corps alone needs 5,000 tons of copper every month for radio and telegraphic and telephonic equipment. An army without copper would be an army without speed, maneuverability or firepower. It would not last a day in battle".

Seven tons of copper for one minute of combat by 50 fighter planes means from 200 to 700 tons of ore, depending upon its grade. Small wonder that the War Department was willing to release drafted miners from military duties to produce more copper.

But other metals are equally important in war: tungsten, nickel, manganese, chromium, vanadium and molybdenum for alloy steels; zinc for brass and die castings; tin for bronze and bearings; aluminum and magnesium for aircraft; lead and mercury for ammunition; silver for electrical equipment, bearings and solder, and so on. Even relatively insignificant non-metallics, like mica and diamonds, suddenly assume critical importance.

And let us not lose sight of the fact that without adequate energy, i.e., heat and power, production, processing, transportation and the relative comforts to which we have become accustomed would be impossible under war conditions. Coal is the major source of energy in the United States. It supplies more than half the total in normal years.

The railroads of the country alone used 110,000,000 tons in 1942 to move freight and passengers and service their facilities. Utilities consumed over 68,000,000 tons in the production of electric power. Over 135,000,000 tons of coal were consumed last year in maintaining the level of heating comfort necessary for the maintenance of efficiency and morale. The consumption, this year, will be even greater.

In short, the mineral products of the earth are the prime necessities of war.

The nations that control the world's mineral resources and make the most efficient use of them will win the victory.

Before the war, the British Empire and the United States together controlled probably 75 per cent of the world's mineral production. This would have been a most potent weapon in the United Nations' arsenal if the whole strategy of Axis expansion had not been influenced by mineral objectives. Addressing the American Zinc Institute on the subject last April, E. W. Pehrson, of the U. S. Bureau of Mines, estimated that the Axis had improved its position in world mineral resources in the following percentages: iron ore, from 6 to 46; steel production capacity, 20 to 34; petroleum, 1 to 7; coal, 27 to 53; copper, 5 to 10; lead, 7 to 22; zinc, 16 to 27; tin, 1 to 72; manganese, 2 to 30; chrome, 3 to 30; tungsten, 6 to 60. In the light metals, areas now Axis-controlled produced in 1940 54 per cent of the world's aluminum, 49 per cent of the bauxite (the principal source of aluminum) and two-thirds of the magnesium.

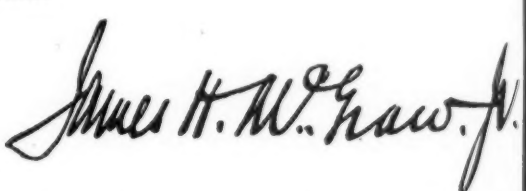
Despite these gains, the industrial war power of the United Nations still can outweigh that of the Axis by a considerable margin. It already has begun to surpass it. The problem is to convert quickly our potential mineral resources into implements of war. In this conversion, a heavy burden of responsibility has been placed on the mining industry of the United States as the largest producer of many metals, minerals and fuels. In fact, the United States mining industry began to go on a war basis a year before Pearl Harbor. The curves of demand for domestic copper, lead, zinc and other metals began to rise sharply in 1940, and were paralleled by a rising coal production.

How well the job has been done cannot be revealed in accurate figures in many cases because of censorship. In metals, however, some idea of production gains can be indicated in comparative terms. United States copper production, for example, is breaking all previous records. Aluminum capacity will be more than seven times its annual peace-time average. Magnesium plants now building will have a capacity 100 times the largest yearly before-the-war figure. Molybdenum, of which the United States has the largest single mine in the world, is being made available in record quantity. Zinc, lead and mercury are surpassing expectations in meeting wartime demands, and tungsten, chromium, manganese, antimony and iron and steel are being turned out in record-breaking quantities.

Bituminous coal production in 1942 was 580,000,000 tons, the greatest in history, valued at more than $1,300,000,000 at the mine. Some 430,000 or more men were employed in 1942 and received at least $750,000,000 in wages. Bituminous production in 1939 was 394,855,000 tons, while the output for 1943 is forecast at approximately 600,000,000 tons – another new United States record. The 1942 anthracite output was 59,961,000 tons, valued at over $270,000,000 at the mine. The industry employed some 85,000 men and paid out at least $180,000,000 in wages. The 1939 production of anthracite was 51,487,000 tons, and the forecast for 1943 is 65,000,000 tons or more.

This is the eighth of a series of editorials appearing monthly in all McGraw-Hill publications, reaching more than one and one-half million readers, and in daily newspapers in New York, Chicago and Washington, D. C. They are dedicated to the purpose of telling the part that each industry is playing in the war effort and of informing the public on the magnificent war-production accomplishments of America's industries.

Marshalling the Western Hemisphere's mineral resources, the United Nations have been the beneficiaries of the diversified resources of two continents – in particular of Canada's nickel and coal, Mexico's lead and antimony, Chile's copper, Bolivia's tin, Peru's vanadium, Brazil's iron, and Venezuela's petroleum. With other United Nations contributing their share of metals and fuel, the grand total is an impressive array of potential munitions and matériel to lend assurance of certain victory over the Axis. Sheer weight of metal, properly used, will win the war, and our mineral industry will have played an indispensable and essential part in the inevitable outcome.



President, McGraw-Hill Publishing Company, Inc.

How to Layout Diesel Intake Systems

Air is as necessary to good engine operation as fuel. Glenn Boyer, Burns & McDonnell Engineering Co, gives practical pointers on intake construction

▸ SUCCESSFUL OPERATION of a diesel engine depends so much on adequate and correct intake-air-system layout that too much emphasis cannot be placed on this phase of plant design. Intake air must be supplied to the engine free from foreign materials which would cause damage or injurious wear to working parts, and in quantity sufficient for proper combustion of the fuel.

Clean intake air is a primary requirement. Examination of deposits on cylinder walls and ring grooves of engines operated without air-cleaning equipment shows that over 40% is foreign matter that entered with the air. A considerable portion of the foreign matter is silicates which, in the presence of heat, fuse into glassy abrasive particles.

Air pollution varies from high concentrations of several pounds per 1000 cu ft in the desert sections of the western states, during severe dust storms, to less than 0.2 grains per 1000 cu ft in some areas. Even this latter low dust concentration, if not removed, will cause difficulties in the engine, over a period of time.

Filters Available

Most engineers are familiar with the filters available. These include the dry filter, constructed of fabric or spun-glass fiber through which the air is strained, and the viscous-impingement unit in which the air passes through stranded or crimped wire or screens of graded meshes, coated with oil to catch and hold the dust particles. Automatic viscous-impingement filters contain a continuous chain of filtering elements which revolves slowly, dipping into an oil chamber at the bottom of each revolution. This arrangement automatically cleans and recharges the filter cells without interrupting operation.

Oil-bath filters work on what amounts to the reverse of the viscous-impingement principle in that the air passes through an oil spray which coats the dust particles. These are, in turn, trapped on a filter element. Heavy dust particles sink in the oil and do not reach the filter. Electrostatic precipitators, used for removing flyash from stack gas and for air cleaning in industrial and comfort air-conditioning installations, also offer interesting possibilities for cleaning diesel intake air.

Each filter type offers advantages with respect to efficiency, ease of maintenance and cost. The relative importance of these factors must be weighed in selecting a filter for any particular installation. The performance characteristics of various filters are discussed at some length in "Characteristics of Air Cleaners Used on Diesel and Gas Engines," by W K Gregory, (Proceedings National Oil and Gas Power Conference, June 1940).

Disturbances have been caused in

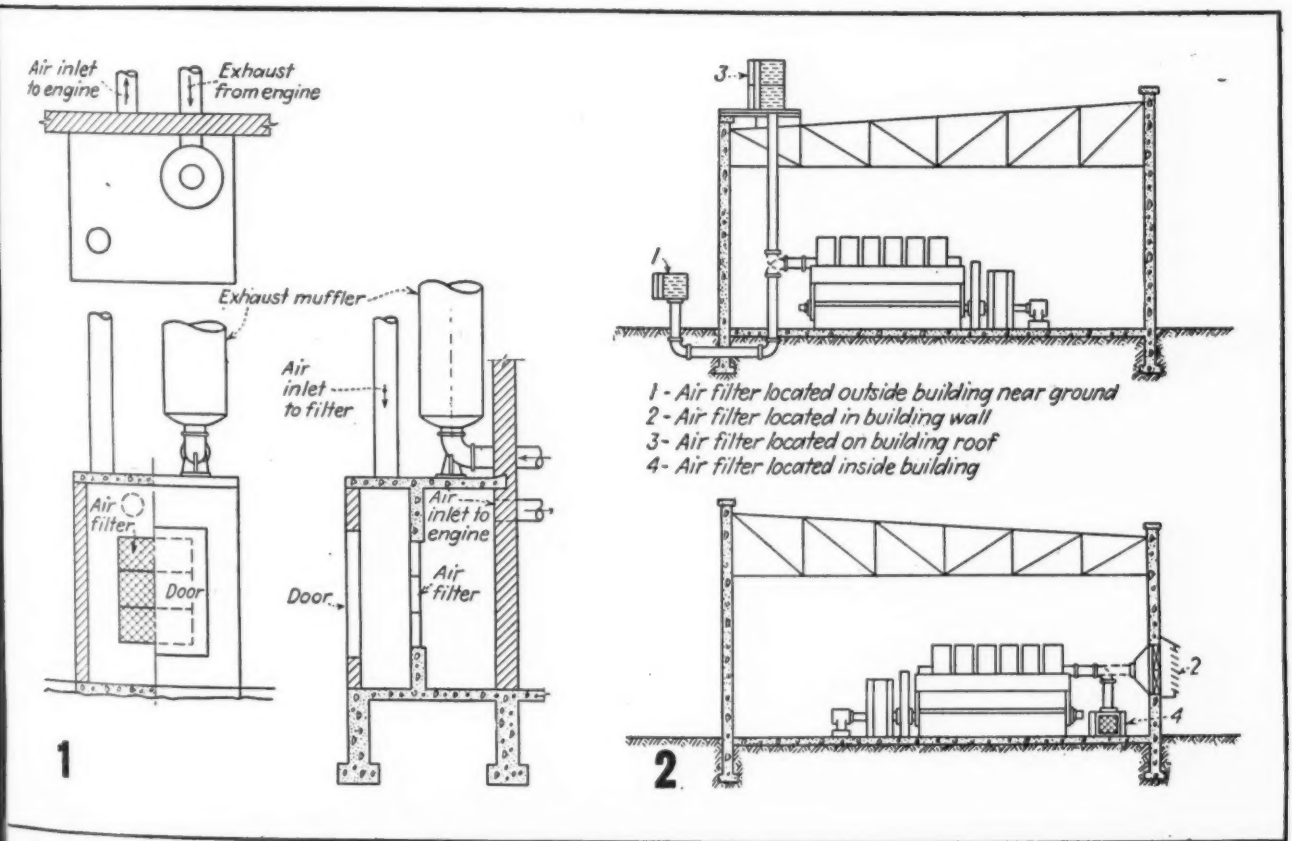


Fig. 1—Filter housing arrangement which supports exhaust muffler. Fig. 2—Four typical air filter and intake-piping layouts

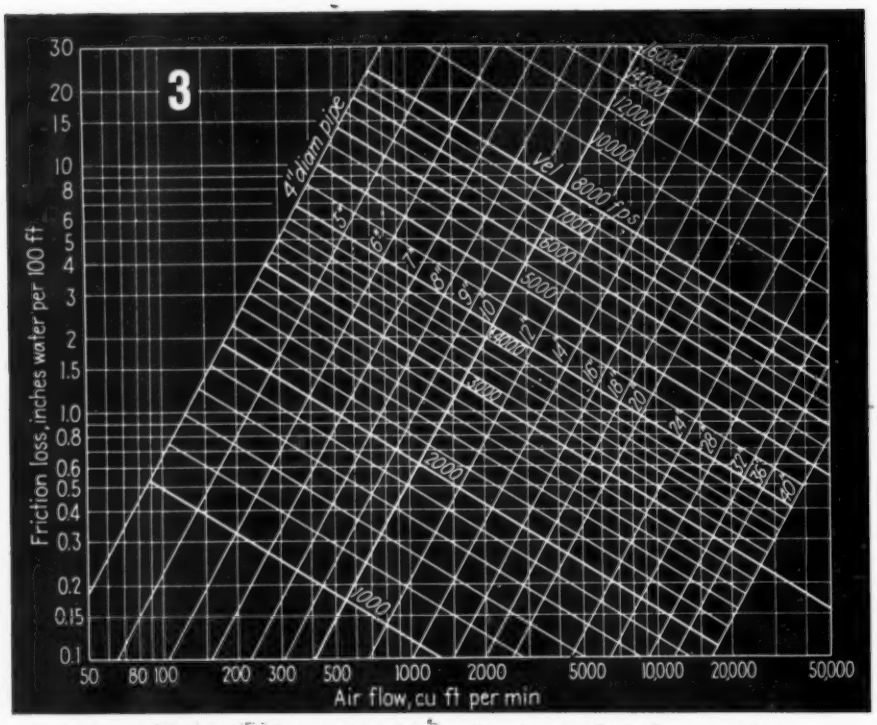


Fig. 3—Chart for determining friction loss in round air ducts or pipes

many instances by the resonant effects of pulsating intake-air flow. This is particularly likely where the air intake is confined, as in an alley between two buildings. Vibrations which manifest themselves either in the structure housing the engines, in adjoining buildings or at some distance from the plant may be caused by inadequate muffling.

Intake Muffling

Provision of mufflers for air intakes should receive serious consideration whenever there is a possibility of creating annoyance. Intake muffling for 4-cycle engines is relatively simple and may be accomplished by installing a filter having some muffling properties. Muffling the intake of 2-cycle engines, particularly of the pump-scavenging type, may present a more difficult problem. Blower-scavenging 2-cycle engines may produce a high-pitched tone and Buchi superchargers and high-speed fans sometimes produce a whine.

There are several things which can be done to eliminate objectionable air-intake noises. Installation of a suitable muffler, after consultation with specialists, usually represents the most satisfactory solution. Providing a large plenum chamber between air filters and the air inlet pipe to the engine tends to reduce pulsations at the filter. Bringing the air into the filter housing from a high level, Fig. 1, often proves effective. Installation of a venturi nozzle in the entrance of the inlet air pipe to the engine also helps to reduce noise.

Location of diesel-engine air intakes depends on design of the structure housing the plant and on the limitations imposed by the length and diameter of air-intake line required. Air intakes may be located near the ground and adjacent to the power-plant building, in the building wall, on the roof, or, in some instances, within the building proper, Fig. 2. The latter location, inside the plant, should not be used unless absolutely necessary to satisfy special design requirements. This arrangement takes air for combustion from inside the building, making it difficult to heat the plant adequately in cold weather.

If the filters and air intake stand on the building roof, cleaner air is obtained in most cases and amount of filter cleaning is less than when filters are near the ground. However, roof-mounted filters must be made readily accessible for cleaning; otherwise they will be neglected and unsatisfactory engine operation and power loss will result.

In general, filters fit best into over-all plant design and operation when they are located either adjacent to the building at some slight elevation above ground, in the building wall or in a housing attached to the wall. Fig. 1 shows a housing arrangement that supports the exhaust muffler.

While the foregoing discussion of air-intake and air-filter location has been based primarily on the use of dry or viscous-impingement units, the same general remarks apply, with slight modifications, to other filters.

Air Requirements

The quantity of air required for proper combustion and scavenging depends on the type and design of engine. Although there is considerable variation in the quantity of air needed by various types of engines, it is not particularly great when comparison is made between engines of a given type produced by different builders. This is shown in Table I.

Major importance attaches to determination of correct pipe size for air intakes. Pipe size must be such that pressure drop resulting from flow through the line will not exceed 5 to 5.5 in. H_2O, or approximately 0.2 psi. For air under pressures less than 2 psi gage, and where pressure drops run less than 10 in. H_2O, using formulas normally applied to flow of water introduces only a slight error in the calculations.

The basic flow equation is:

$$V_s = \sqrt{2gH}$$

where V_s is velocity, in fps; g is acceleration caused by gravity (32.2 ft per sec^2); and H is head causing flow, in ft. of air. If velocity is given in fpm, the equation becomes:

$$V = 1096.5\sqrt{\frac{h}{W}}$$

where V is velocity, in fpm; h is head or pressure, in in. H_2O; and W is weight of air, in lb per cu ft. For air at 70 F

TABLE I—Air Required by Various Types of Diesel Engines

Type of engine	Air required per rated bhp lb per hr	cfm at 60 F
4-cycle mechanical injection	10–13	2.2–2.8
4-cycle air injection	12–15	2.6–3.3
2-cycle mechanical injection, pump scavenging	22–23.5	4.8–5.1
2-cycle air injection	20–22	4.3–4.8
2-cycle mechanical injection, crankcase scavenging	18	3.9

Note: For air volumes at other temperatures apply following corrections:

Temperature	70 F	80 F	90 F	100 F
Multiplier	1.02	1.04	1.06	1.08

All volumes are based on dry air and barometric pressure of 29.921 in. Hg.

with a barometric pressure of 29.92 in., the equation simplifies to:

$$V = 4005\sqrt{h}$$

Thus the air velocity for a pressure or head of 1-in. H_2O at standard conditions, and neglecting friction, would be 4005 fpm. Further reference will be made to this last equation in connection with finding pressure loss in pipe entrances and bends.

Two kinds of pressure loss occur when air is required to move in a confined space. These are frictional loss from contact of air with walls of pipe or duct, and the loss resulting from change in direction of air flow or change in duct size. The loss in pressure caused by air flow in straight pipes has been calculated by various empirical formulas. The simplest of these, which gives fairly accurate results is:

$$h = \frac{K V^2}{D}$$

where h is pressure drop or head, in in. H_2O; per 100 ft; V, is velocity, in fps; D is diameter of duct, in ft; and K is a constant varying from 0.00055 to 0.000635.

Pressure drop resulting from air flow in round ducts or pipes can be easily found by use of a chart such as Fig. 3. This chart, based on an empirical formula somewhat different from that given above, gives friction losses slightly less than those calculated by means of the equation.

In addition to friction loss in straight pipe runs, losses occur at pipe bends and at points where pipe changes size. These losses are generally measured in *velocity heads.*

As shown previously, air pressure of 1 in. H_2O creates an air velocity of 4005 fpm, neglecting friction. The equation $V = 4005\sqrt{h}$ can be rewritten:

$$h = \left(\frac{V}{4005}\right)^2$$

In this form h is ordinarily referred to as *velocity head.* Fig. 4 gives values of h for velocities ranging from 400 to 10,000 fps.

To illustrate use of the formulas and charts developed, consider that the air-intake line for a 500-hp 4-cycle mechanical-injection engine is 40 ft long and contains one 90-deg bend with an R/D ratio of 1 and an abrupt change in line size at the filter-housing connection. What pipe size will keep pressure drop to the desired maximum of 3 in. H_2O? Table I shows that the engine requires 2.5 cfm per bhp at 60 F. The total air required at 70 F becomes $2.5 \times 500 \times 1.02 = 1280$ cfm.

Fig. 3 shows that, for an air flow of 1280 cfm and a 7-in. pipe, the air velocity is 4700 fpm and the pressure loss per 100 ft is 4.9 in. H_2O. This amounts to $0.4 \times 4.9 = 1.96$ in. H_2O for a 40-ft pipe.

Fig. 4 gives a velocity head of 1.35 in. H_2O for 4700-fpm velocity. The loss through the 90-deg elbow and entrance is:

$$1.35(0.5 + 0.26) = 1.02 \text{ in. } H_2O$$

Total loss through pipe and fittings is 1.96 plus 1.02 or 2.98 in. H_2O.

It appears that a 7-in. pipe meets the requirements as to pressure drop. Because this pipe size is not normally carried in stock, use an 8-in. pipe. This represents the smallest standard pipe size available in which the allowable pressure drop (3 in.) will not be exceeded.

These calculations assume that air flows through the intake line at constant velocity. This assumption is never strictly true, although in the case of 2-cycle engines with blower scavenging or 4-cycle engines of six or more cylinders, it is sufficiently close to actual conditions. In 2-cycle pump-scavenging and either 2- or 4-cycle engines of less than six cylinders, there is a considerable variation in air velocity unless provision has been made to iron out

(*Continued on page* 138)

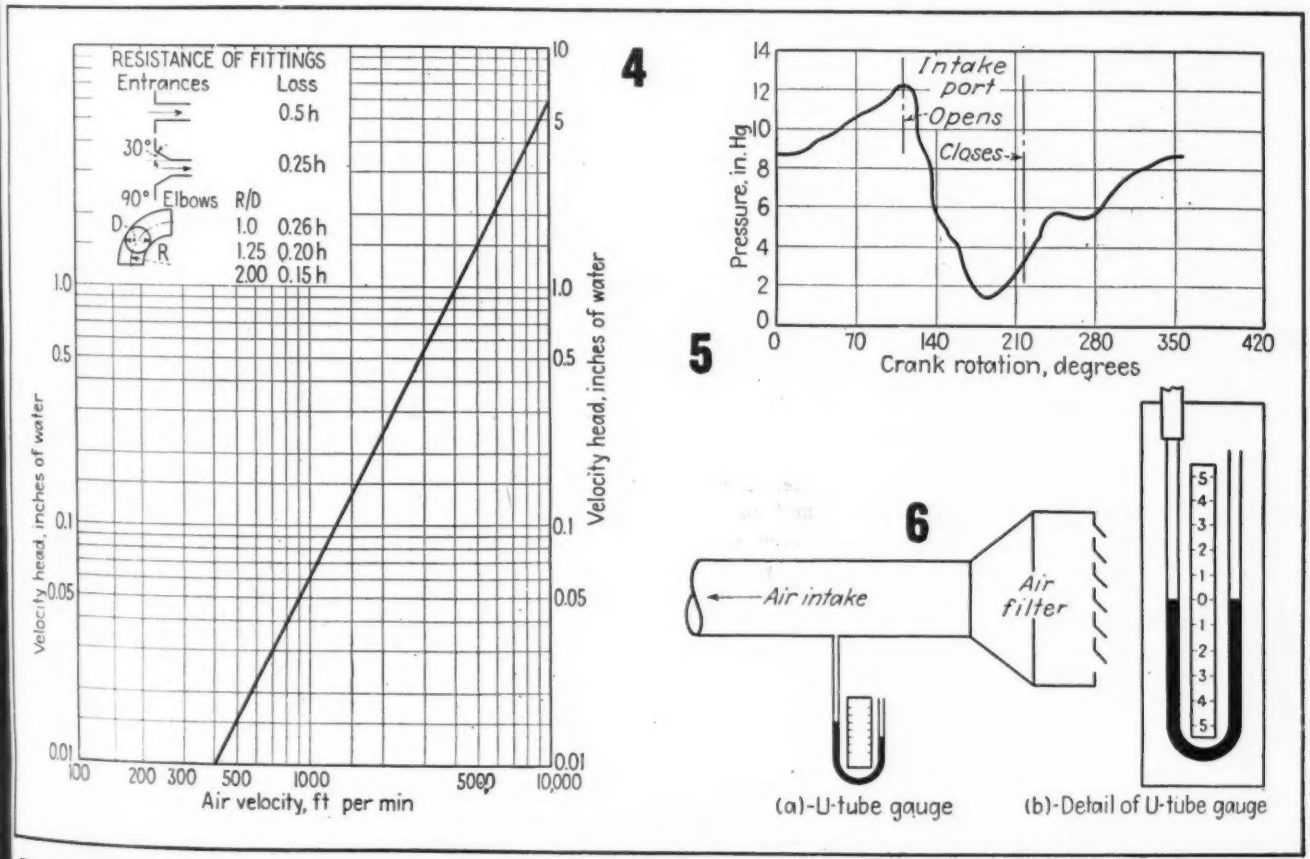


Fig. 4—Velocity-head chart and resistance of fittings. Fig. 5—Variation in intake pressure plotted against crank rotation, for a single-cylinder engine. Fig. 6—Convenient U-tube device for measuring intake-system pressure drop and checking filter condition

THE OLD CHIEF

Case Histories

Another in the series by William Doran, chief engineer, Essex County Sanatorium, Windsor, Ontario. Writing of the inspiration of the past, he has captured much of the human side of engineering that lies behind the wavy lines on paper disks

". . . a heavy tool box on his shoulder . . ."

▶ I KNOW A PLACE up in the highlands where I sometimes spend my holidays, where there is a lonely old cemetery in the middle of a wooded lot, miles from any human habitation. The old tombstones are not very informative. They give you the names, dates of entrance and exit, and leave you to conjure up in your mind what manner of men they were and how they rubbed shoulders with their fellow men.

Measure of a Man

Down at the old plant, our employment record book seldom gave out any more enlightenment regarding our former employees than did the tombstones. But thanks to the Old Chief, I learned many of the stories that were missing from the meager records.

The story of Red Hogan is, perhaps, a good example. His curly red hair, red face and flowery manner of expressing himself made him an unusual character. To quote him, he was "raised in the bush and brought up in the construction camps." He had fired portable boilers or, as he called them, donkey boilers, all over the Union and had worked at every kind of job that called for a strong back and a case-hardened constitution.

The Hitchhiker

Spring would see him punching rivets over a swift-moving river; summer, bucketing blue clay out of a big cut. Autumn would likely find him nursing a well-boring outfit; winter, broke and stranded in some city with odd jobs sandwiched in between drinking spells.

The Old Chief first met Red as he was trudging along a rough road, a heavy toolbox on his shoulder and a dilapidated bag in his hand. He was rain-soaked to the skin and gladly accepted a ride to town. He was broke, slightly tipsy and soured on the world; his object was to get as far away from steam boilers as possible.

It was Red's considered opinion that any man who chose steam-making as a means of earning a living should be locked up in a padded cell. As for him, he was going chicken farming, or raising silver foxes, or something. No more leaky tube sheets, coal scoops or balky reversing gears for him. "*Boilers and him were through.*" The Old Chief bought him a meal and a bed and told him that he was looking for a man to do farming; he told Red where to find him.

Coal-Scoop Shepherd

Red showed up next morning and found that the farming consisted of herding coal from the bunkers to a battery of boilers and, also, that he could start work right away. He scratched his chin for a moment, then closing his eyes he said, "Mister,

"The lark is up to meet the sun,
The bee is on the wing,
The ant his labors has begun,
The woods with music sing.
Give me a coal scoop."

He turned out to be a dandy workman, always doing his own work and half of the other fellow's; but he was restless. Every time he heard a train whistle he looked longingly out the window. Well-earned promotion and the advice of the Old Chief kept him from quitting. His strength and his remarkable coolness in emergencies made him an ideal man around a plant that was running away over its head.

Alas, poor Red. One day he gloomily said to the Old Chief,

"The hardest words in song or pen
Are those three words
On tramp again."
"I'm agoin' East."

"What's the matter, Red?" asked the Old Chief.

"I'm going to tell you something, Chief," replied Red.

Pause. "The walls are closing in on me, I'm taking root, I ain't free no more. Last Sunday I found myself in church an' that's no place for a bum like me."

But Red agreed to wait until the big boiler was overhauled and by the following spring a change had come over him. He quit chewing, he gave away his Mackinaw coat, he started to study. He lost his flair for flowery and blasphemous language.

Dark Eyes Claim Red

And the cause of all this was a cultured and dark-eyed little lady, who was related to most of the best families in town. The mighty Red had fallen. Some construction boss had lost a hard-hitting craneman and we had gained the best boiler-room foreman in the state. For which we bowed low to the little lady with the dark eyes.

THE OPERATING ENGINEER

George Edwards
Advisory Editor

PRACTICAL AIDS • MAINTENANCE HINTS • QUESTIONS—ANSWERS

PUBLISHED MONTHLY AS AN INTEGRAL PART OF POWER

Sprayed Metal Saves Material

Worn machine parts ordinarily headed for the scrap pile start a new life when reconditioned by metal spray. American Sugar Refining Co engineers say that, while not a cure-all, this method of repair offers the best answer to many of their ordinary maintenance problems

TO THE ENGINEER, maintaining a plant means combating his natural enemies, corrosion, erosion, and wear of moving parts. Time often dictates what methods are most suitable for repairing damaged machines. When machine outage drastically reduces plant output the repair must be made in the shortest possible time. Even when the cost of a new part is justified a quicker repair sometimes results from building up the point of wear to permit reinstalling the old part without disturbing adjustment of attached arms or cams. Adjustments on complicated machinery can waste more time than that consumed in making repairs.

Under war conditions, need to conserve strategic materials puts a premium on repair instead of replacement and on repair methods that are economical of restricted material.

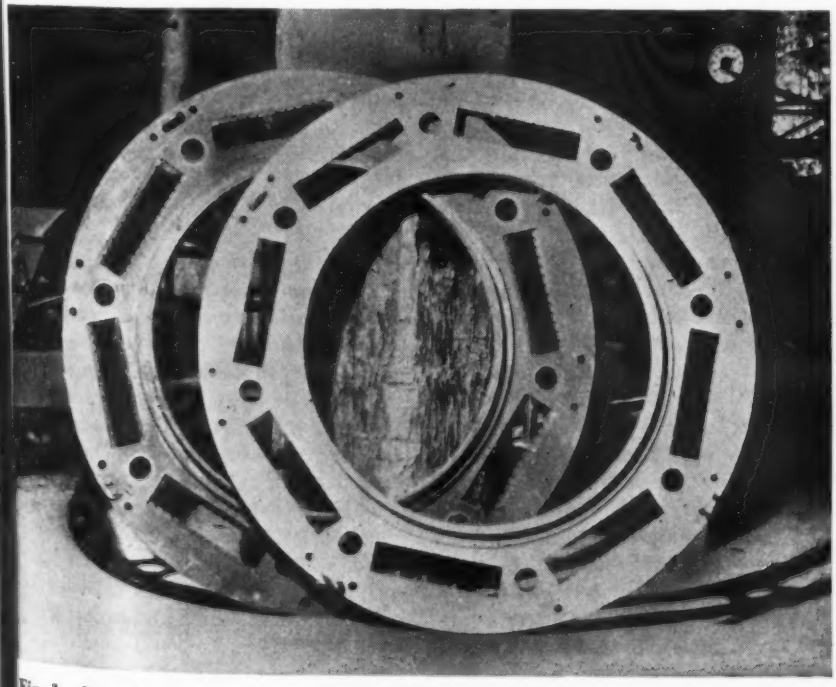


Fig. 1—Spraying mold plates prevents corrosion and stops sugar discoloration

F M Gibson and J W Gibbons, American Sugar Refining Co, began using the metal-spray process in 1932 to repair machine parts and to protect surfaces against corrosion. They have been able to save time, materials, and money by buildng up worn areas on shafting, valve stems, and pump rods instead of purchasing new parts. In many cases repaired areas gave better service than the original because the built-up metal offered greater resistance to wear. Cost of parts forged from tough, wear-resisting metals is often prohibitive and where ordinary steels have adequate strength, wearing surfaces can be faced with a small amount of alloy material that is better able to resist wear.

Many Different Uses

Successful applications have been made on turbine governor spindles, river-water pump casings, engine throttle-valve stems, pump and motor shafts, crankpins and wristpins, pump piston rods and machine shafting to build up worn parts. Sprayed metal applied to the inside of tanks, centrifugal driers, coolers, filters and tank trucks protects against corrosion from sugar liquor. This metal coating not only protects the base metal against corrosion but also prevents contamination of the sugar from corroded particles. Absence of all black specks or coloring matter from the product is in itself reason enough for the application of a protective coating to containers.

On the centrifugal driers for specialty sugar, the cast-iron frames, syrup gutters and wrought-iron casings were scaling badly from corrosion. Spraying all parts with zinc 0.025 in. thick has given complete protection against abrasion from sugar crystals as well as against corrosion. The sugar-mold separators were sprayed with aluminum. Both the driers and molds remain in good condition after seven years' service.

Results In Definite Saving

Savings made by repairing the casing of a salt-water pump illustrate the value of this method. Water action had eroded the cast-iron casing to such an extent that it meant either making repairs or purchasing a new bronze casting costing approximately $2200. Considerable experimenting was necessary before a suitable combination of metals was found. The final application consisted of a primary coat of lead, filling all holes, followed by a coat of manganese-bronze 0.380 to 0.500 in. thick in some places. This job still proves satisfactory after three years. Filling the honeycombed areas and covering the entire inside surface with a complete coating cost only $240.00 and increased the pump capacity. After returning the unit to service the output jumped from 5000 to 6500 gpm.

Seven years ago spraying of liquor-storage tanks was begun. Previously many different kinds of paint and enamels had been tried with but little success. Experience with the first tank showed the impossibility of removing the liquid from behind riveted seams and angle brace supports. Liquid trapped at these joints seeped out and flowed behind the coating, causing early appearance of rust spots. Welding a one-bead layer around the edges of these joints provided a tight seal over which the sprayed zinc was applied.

Experimental application of hard rubber, with the powder gun, was made on two filter bottoms to determine suitability for this service. Sprayed rubber usually becomes plastic at temperatures above 140 F but the weight of the filtering medium has held the rubber in place four years even at temperatures above 212 F.

These few successful applications and the corrosion-resisting qualities of the applied metal warranted the purchase of a second complete spraying outfit. During the following years metal spraying has been used to coat the inside of process tanks, filters and other items of equipment too numerous to mention. Choice of metal coating has been governed entirely by the service; trials and experience determine which metal or plastic is best suited for each problem. Metals are applied with a wire gun; rubber and other plastics must be applied with a powder gun, which is also suitable for spraying metals in a finely pulverized form.

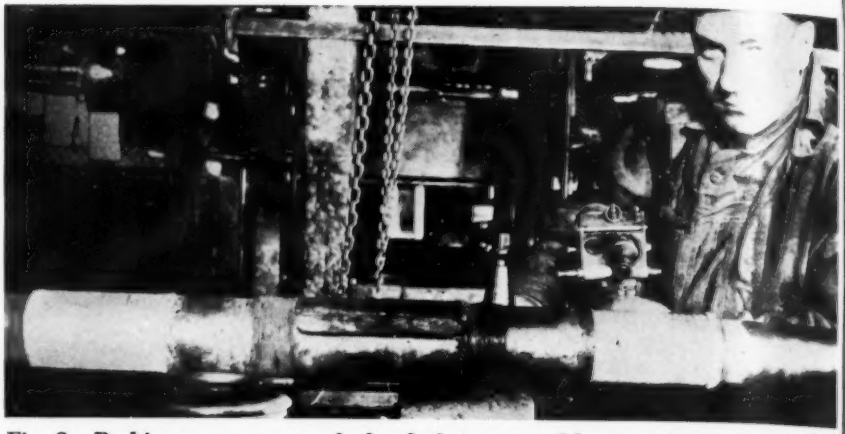


Fig. 2—Packing scores removed, the shaft is restored by spraying and machining

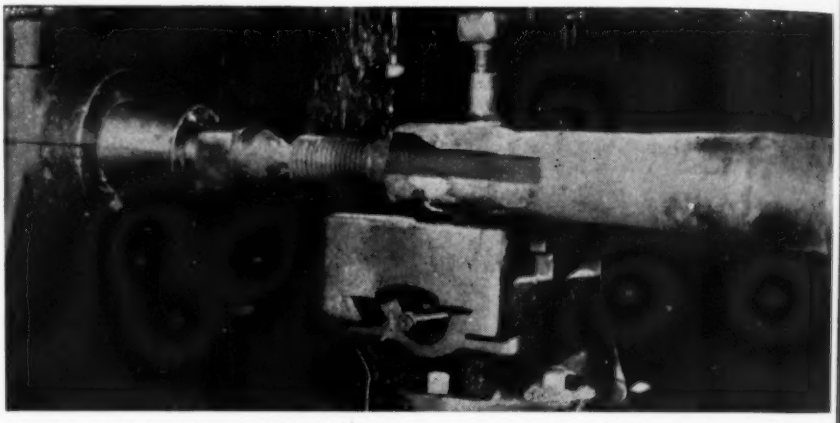


Fig. 3—Coal-crusher spindle before restoring taper and keyway by metal spray

Building up worn parts by metal spray is especially valuable when obsolete machine parts show wear. Replacement requires special machining that increases the cost greatly. A throttle-valve stem on a Rice & Sargent engine became badly worn. As this valve was no longer manufactured, parts could not be purchased. Undercutting the stem for a distance of 6 in., the surface was roughened and a layer of high-carbon steel applied, building the stem to a larger diameter over that area. Grinding reduced the stem to size with a good smooth finish and it is now nine years old.

Ten years ago a governor-spindle sleeve on one of the power-house turbines reached the stage where it was necessary to shut down the turbine until a new sleeve was installed. As this particular governor was obsolete, the manufacturer required three weeks for delivery at a cost of $140. The sleeve was built up by metal spray, turned to size, and reinstalled, requiring a total outage time of 24 hours. The complete job, including labor and metal, cost $15.

Numerous pump and motor shafts have been saved from the scrap heap by building up worn areas at packing glands and bearings. Packing-gland leakage persists when the shaft is scored because score marks cut new packing and excessive gland pressure tends to cause additional wear, especially if abrasive matter is present. Building up the shaft areas at friction points allows selection of a metal or alloy more capable of withstanding this friction and wear.

Costly Machining Avoided

The impeller shaft for a large pump was severely scored at the stuffing boxes, allowing air to enter at this point and causing loss of prime. Examination showed the shaft badly worn next to the packing. Being fabricated from crucible F12 stainless steel, heat-treated and hardened, the shaft was worth approximately $90.00 in the rough. Machine work on the shaft included a marine thrust on one end and a special coupling on the other with screw threads along the mid-section for impeller clamping nuts. Saving this valuable piece of material involved machining away the worn areas to form a rough bonding surface and building up

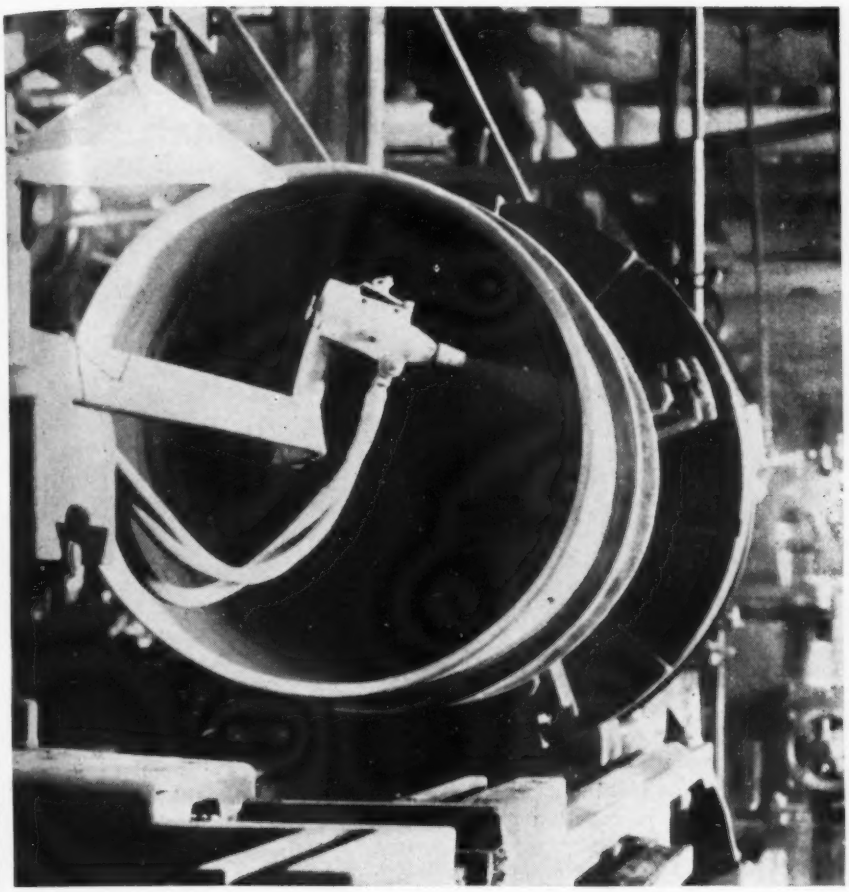


Fig. 4—Convenient lathe setup for spraying the inside of sugar-liquor drums

with sprayed stainless steel No. 2. This job is now six years old.

Installing new motor shafts is a costly and time-consuming job. On dc motors, and American Sugar Refining uses hundreds, it generally means complete rewiring and rebuilding of the commutator. Rather than resort to this method some operators have the shaft machined to a smaller diameter and fitted with smaller bearings. Reducing the journal and bearing size not only results in higher bearing pressures but necessitates carrying many odd-size bearings in stock. At American Sugar, they apply built-up metal to restore normal journal diameter. Building the shaft to its original size eliminates the cost and time of installing a new shaft, keeps the bearing pressures normal and permits stocking of regular bearing sizes. Sprayed-metal journals form good bearing surfaces because the innumerable pores hold and carry oil over the bearing. Stainless steel No. 2 serves where grinding is possible, because its hardness prevents machining; No. 1 must be used when space does not permit the entrance of a grinding wheel.

Other shaft problems occur in the complicated packaging and handling equipment. Outage time on these machines, handling a large percentage of plant output, must be kept at the absolute minimum; otherwise thousands of dollars will be lost in production alone. Cost of a new shaft, although high, is a small item compared to production loss; new installation consumes more time than required to repair the old shaft by metal-spraying the worn areas. These shafts, fitted with cams and levers which, once removed, throw the entire machine out of adjustment, are better left intact whenever possible. Spraying and machining of the worn areas requires only an hour and a half and saves, in the cost of a new shaft alone, the appreciable sum of $130.

Extreme Service Conditions

Pump rods, piston rods, valve stems, crankpins and wristpins are some of the many power plant items that have been built up and repaired successfully by spraying on additional metal. Taper shaft ends for crossheads and gears are built up and pressed into place as good as new. Taper fits have been pressed into place under pressure exceeding 40 tons and removed without disturbing or destroying the built-up metal. The taper and keyway on the pusher-arm shafts of four coal crushers, subjected to heavy duty, were found worn and loose. Building up the taper and keyway restored the fit; the shafts were then reinstalled and have been operating continuously for five years.

Each application helped to show other uses where the method would serve. Inspection of furnace stack breeching, 9 ft in diameter and 82 ft long, installed out of doors, showed evidence of serious internal corrosion over the entire length, including 14 feet up the stack itself. Condensation uniting with sulphur in the furnace gas had formed weak sulphuric acid that attacked the metal surfaces. Sandblasting removed the rust and cleaned the surface and sprayed lead protects against any further corrosion.

Metal spraying is useful for many repairs but American Sugar Refining Co engineers feel that it cannot be considered as a cure-all. The following recommendations result from tests and studies made in this plant:

1. Use low-carbon steel as a bond on cast iron before applying high-carbon steel.

2. Zinc provides a good bond coat on steel before applying aluminium.

3. Sandblasting is preferred to metal shot for cleaning the surface. Sand grain impingement is sharper and closer. Rusted shot leaves spots on the surface.

4. When spraying over welded areas, use bare rod for welding, or heat weld to burn away remains of flux.

5. Use air that is dry and spray only when atmosphere relative humidity is below 70%.

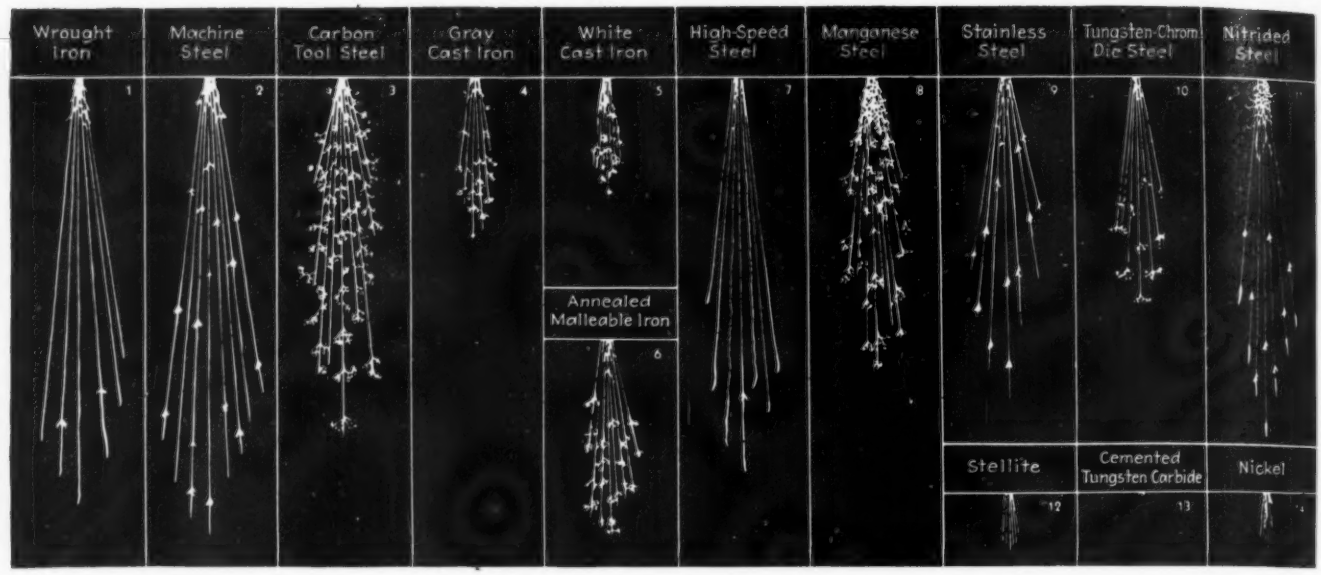
6. When spraying a shaft, make a complete pass for each coat. Building up to full thickness in a series of rings results in concentrated heating.

7. Complete spraying in one operation: don't allow a partially completed shaft to lie for several hours between coats.

8. Substitute the groove method instead of rough threading when preparing the end surface of a shaft for spraying. Upsetting the ring edges provides greater resistance against coating movement when it is not anchored at both ends.

9. Operators spraying in confined areas require fresh air supplied through a face piece.

SPARKS FINGERPRINT SCRAP METAL



► IN THE NATION-WIDE drive to get dormant industrial scrap back into war work, as melting scrap or otherwise, every power engineer must play his part. That means sorting as well as collecting. Don't depend on the junkman to rescue precious stainless steels, high-speed tool bits and such like from run-of-mine iron and steel scrap. The costly alloying elements will probably be lost forever by such mixing.

Sometimes you can identify such items as tool bits by shape, markings and use. Just as often the expensive and rare alloy carries no outer mark indicating its composition. If not, grinder sparks will generally identify the metal, just as fingerprints spot the man. Table and sketches, reproduced with permission from *Metals and Alloys*, were originally prepared by the Norton Company, Worcester, Mass.

Make the spark tests on a high-speed power grinder arranged so sparks fly horizontally and can be viewed in dim light against a dark background. Naturally, the sparks will vary somewhat from the sketches, according to type of wheel, speed and pressure. For a good final check, compare sparks from the "unknown" metal with those from standard samples of known composition.

Referring to the numbers in the tables, you can usually bunch 1, 2, 4 and 5 together for melting purposes. It is sometimes permissible to put 3 into the same batch, but separate storage of high-carbon steel will generally reveal pieces that you can reuse as tools. If possible, store separately each composition from 7 to 14 inclusive; and label them separately because all these items are rare and costly.

Item 15 should be broken down—copper and copper alloys in one pile, aluminum and aluminum alloys in another. Magnesium alloys, also, should be kept separate.

Metal	Volume of Stream	Length of Stream, In.	Color of Stream Near Wheel	Color of Streaks Near End	Quality of Spurts	Nature of Spurts
1. Wrought Iron	Large	65	Straw	White	Very few	Forked
2. Machine Steel	Large	70	White	White	Few	Forked
3. Carbon Tool Steel	Moderately large	55	White	White	Very many	Fine, repeating
4. Gray Cast Iron	Small	25	Red	Straw	Many	Fine, repeating
5. White Cast Iron	Very small	20	Red	Straw	Few	Fine, repeating
6. Annealed Malleable Iron	Moderate	30	Red	Straw	Many	Fine, repeating
7. High-Speed Steel	Small	60	Red	Straw	Extremely few	Forked
8. Manganese Steel	Moderately large	45	White	White	Many	Fine, repeating
9. Stainless Steel	Moderate	50	Straw	White	Moderate	Forked
10. Tungsten-Chromium Die Steel	Small	35	Red	Straw*	Many	Fine, repeating* Forked
11. Nitrided Steel	Large (curved)	55	White	White	Moderate	
12. Stellite	Very small	10	Orange	Orange	None	
13. Cemented Tungsten Carbide	Extremely small	2	Light Orange	Light Orange	None	
14. Nickel	Very small**	10	Orange	Orange	None	
15. Copper, Brass, Aluminum	None				None	

Figures obtained with 12-in. wheel on bench stand and are relative only. Actual length in each instance will vary with grinding wheel, pressure, etc.
* Blue-white spurts. ** Some wavy streaks.

SHORT QUESTIONS – QUICK ANSWERS

About Air Compressors

Q—Enumerate precautions to be taken before the initial starting of an air compressor.

A—First check the oil level in all oil reservoirs and fill the cylinder lubricator. A good policy during erection is to cover bearings, journals, and cylinder walls with a light oil film during assembly. This initial oiling serves for the first few revolutions of the machine. Operate the lubricator by hand to force a small quantity of oil into the cylinders. Make a thorough inspection of the unit for loose parts or foreign material and then turn the machine several times by hand to make sure that all moving parts are free. Turn on cooling water and check for obstructions and leaks.

When control of the driving unit permits, apply power momentarily and allow the machine to drift to a standstill. If the hand turning or momentary start produces no evidence of tight bearings, it is safe to operate the unit unloaded. Variable-speed machines can be operated slowly with a gradual increase to full speed; constant-speed machines must be operated at full speed immediately. Bring the unit to rest every five to ten minutes and check all bearings for heat. After running from one to two hours unloaded, partial load can be applied. Increase the load slowly and make frequent shutdowns to inspect bearings and other moving parts inaccessible during operation.

The breaking-in run is important and time and care spent during this period will pay in lower repair bills later on; close observance of the machine will catch defects before damage occurs. After several hours operation it is advisable to remove cylinder heads and inspect internally for lubrication.

Q—How often should air-compressor valves be inspected?

A—Inspect valves at regular intervals, not exceeding 30 days, even when compressor operation is satisfactory. This inspection should include a thorough removal of any foreign deposit found. When valve plates are interchangeable and seat marks are worn into the plate, care must be used in replacing so that the plates are returned to their original location. Otherwise, the seat marks will not coincide and leakage will occur past the plate.

Q—What method is suitable for locating leaks in compressed-air lines?

A—Liquid soap serves best for locating small air leak in joints and valves. A number of leaks that seem small in themselves will total a tremendous quantity of wasted air. Compressor operation on a closed system indicates total leakage. Careful maintenance of piping will, in some cases, eliminate the necessity of installing additional compressors. The table shows cost of wasted air from different-size leaks.

Size of opening, in.	Air wasted per month, at 100 psi, cu ft	Air cost per month, at $.06 per 1000 cu ft
3/8	6,671,890	$400.31
1/4	2,920,840	175.25
1/8	740,210	44.41
1/16	182,272	10.94
1/32	45,508	2.73

Compressed Air Institute

Q—What is meant by the absolute ratio of compression?

A—This is the ratio of final pressure to initial pressure. Both pressures must be stated in absolute values. For example: An air compressor takes atmospheric air and compresses it to 100 psi gage pressure. The 100 psi gage pressure + 14.7 psi atmospheric pressure = 114.7 psi abs. Then 114.7 ÷ 14.7 = 7.8, the absolute ratio.

Q—What pressure will be exerted by a volume of compressed air of 80 F and 100 psi when it is heated to 250 F?

A—As the volume remains constant the resulting pressure can be found as follows: Reducing to absolute temperatures, 80 + 460 = 540 F, and 250 + 460 = 710 F. Then pressure at 250 F is equal to $(100 + 14.7) \times \frac{710}{540} = 150$ psi abs; 150 — 14.7 = 135.3 psi gage.

Q—What practice is recommended for replacing cylinder-head gaskets?

A—It is important that cylinder-head gaskets be made from asbestos or other material suitable for this service. Correct thickness is necessary if piston clearance is to be maintained at the original value. When measuring thickness of an old gasket make allowance for the amount which it has been compressed. The material must withstand heat of compression as well as oil seepage. Ports must be cut in the gaskets to match water or air passages cast in the head; otherwise, through flow will be obstructed. Shellac can be applied to one side to hold the gasket in place but the joint should part easily on the other side.

Q—How should compressor piston-rod packing be adjusted?

A—When inserting new fibrous packing, place the rings so that joints come at different points around the rod. Fill the gland with packing and force it into place with the follower. Do not use excessive pressure and, after the packing is snug, slack off on the gland nuts. Squeezing the packing tightly forces out the lubricant and exerts undue pressure on the rod. After the compressor is warmed up, take up on the packing only enough to prevent blowby. Packing drawn up too tight causes heating, scoring and cutting of the piston rod.

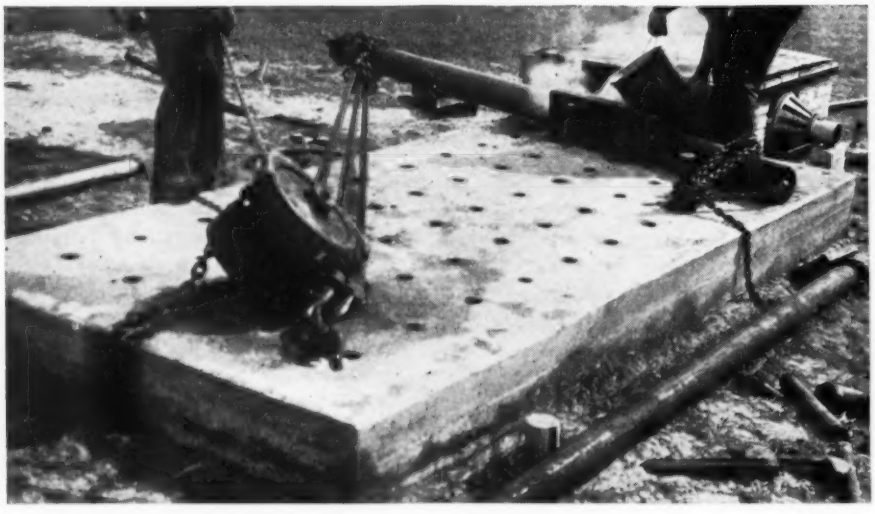
Q—What does the presence of a deposit on compressor valves indicate?

A—Deposit on the valves indicates that, the intake air is dirty, too much or an unsuitable oil is being used, or a combination of both.

Q—How can the intercooler pressure, for equal work in each cylinder, be determined without measuring the cylinder diameters?

A—Assume a compressor takes air at atmospheric pressure and discharges at 250 psi gage. Ratio of compression is: (250 + 14.7) ÷ (0 + 14.7) = 18. Then intercooler pressure $(0 + 14.7) \times \sqrt{18} = 62.5$ psi abs or 47.8 psi gage. Obtain the same result by taking the square root of the product of the initial and final pressures. Then intercooler pressure is $\sqrt{264.7 \times 14.7} = 62.4$ psi abs or 62.4 — 14.7 = 47.7 psi gage pressure.

PRACTICAL AIDS TO OPERATION



Homemade Heavy-Pipe Bender

BENDING HEAVY PIPE is not difficult for competent mechanics who have adequate equipment for doing the work. War restrictions have changed this and one oil-refining company now does its own bending. To do this work they built a concrete bending platform on a plot of ground near plant roadways so that pipe can be delivered and removed easily by truck.

To build the bending platform they dug a pit 13 ft long, 6 ft wide and 2 ft deep and in it placed a wood form 3 ft high. Before pouring the concrete 55 sections of 2-in. extra heavy pipe were set up in the form. These sections were just long enough to reach to the top of the concrete when poured and were set on 12-in. centers. A heavy ring and U-bolt placed in one corner anchored a chain fall to do the bending job.

A gas furnace, built at one end of the platform, heated the pipe before bending. They built the heating furnace, 6 ft long inside, with common fire brick laid up with fire-clay mortar, reinforced at top and bottom with stay bolts and steel straps. The two ends of the furnace were only partly bricked in, leaving space in the center for adjusting the pipe in the flame. A standard gas burner, placed in one side of the furnace and a steel plate cover completed the job.

Accessories included a back rest around which to bend the pipe. This was made from a piece of channel iron, heated and shaped with the flanges on the outside of the curve. Steel pins that would just fit in the 2-in. pipe sections and about 12 in. longer provided the anchors for the pipe when bending. Several pieces of chain with a hook on each end to help anchor the pipe for bending and a 5-ton chain fall to provide the bending force completed the accessories.

When starting to make a bend, the pipe is placed in the furnace so that it will be heated in the desired place. A hand valve in the gas line controls the intensity of the flame according to the judgment of the mechanics doing the bending. The flame should never be hot enough to injure the pipe or badly oxidize its surface. Before placing the pipe in the furnace, in some cases the end nearest the bend is closed by a tack-welded disk with a hole in it to hook in the chain, as in the photos.

When the color of the pipe indicates that its temperature is about right for bending it is removed from the furnace and placed against the bending arc. They anchor the short end of the pipe with chain to one or more posts in the platform and the long end by more chain to the chain fall. The top photo shows workmen bending extra-heavy pipe after heating it in the gas furnace. As bending progresses it may be necessary to quench part of the pipe nearest the anchor post, bottom photo, using water sparingly and with judgment.

Number of heats necessary to make a bend depends on pipe thickness and size, kind of bend and skill of workman. By using a combination of several steel posts in different anchor holes almost any shape pipe can be made for steam and process lines. Two intelligent workmen with a knowledge of metals will soon get the hang of making a good bend after a few preliminary tries.

Compressed-Air Low-Water Alarm

IN THE METROPOLITAN Life Insurance Co home-office building in New York City compressed air is used for a wide variety of purposes. Among these is a low-water alarm on the roof tanks, as indicated in the figure. In the tank a float-controlled ball cock is installed and located so that the float will open the cock when the water drops to the lowest level permitted. A ½-in. pipe connects this valve to a tee at the top of the tank. From the tee ¼-in. pipe connects to the compressed-air supply and to the signal device in the engine

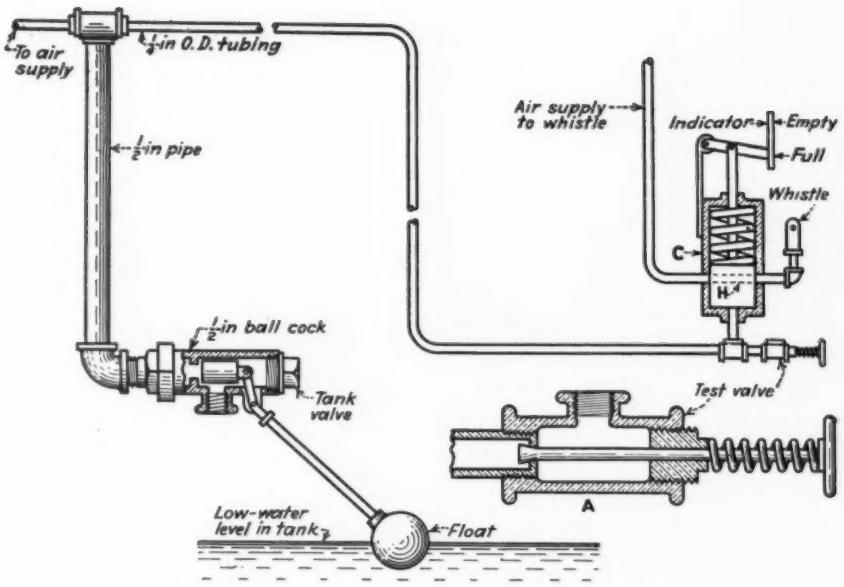
room to call the operator's attention.

The signal device consists of a closed cylinder *C* with a spring-loaded piston in it. An air whistle connects into one side of the cylinder with an air supply line connected into the opposite side. The air line from the tank connects to the bottom of the cylinder and a full or empty indicator connects to the top of the piston rod.

As long as the house pumps function properly from the start-and-stop float switch, water in the tank stays at a level that submerges the ball cock and it remains closed. When this condition exists air pressure is normal under the indicator piston and the piston remains in a raised position to close the passage between the air supply and whistle. With the piston in this position the word "Full" on the indicator shows through a small window in the enclosing case.

If water in the tank drops below the lowest permissible level the ball cock opens, drops the pressure in the air line and the indicator piston falls to the bottom of cylinder *C*, as shown. In this position a horizontal hole *H* through the piston connects air supply line to the whistle to signal the attendant, who can take the necessary steps to correct the fault. When the piston is in its lowest position, the target on the indicator shows "Empty" through its window. A spring-loaded test valve like that shown at *A* connects to the lower end of the air line running to the bottom of cylinder *C*. At any time the attendant can push this valve open to test the indicator by releasing the air from the line.

FIELD EDITOR



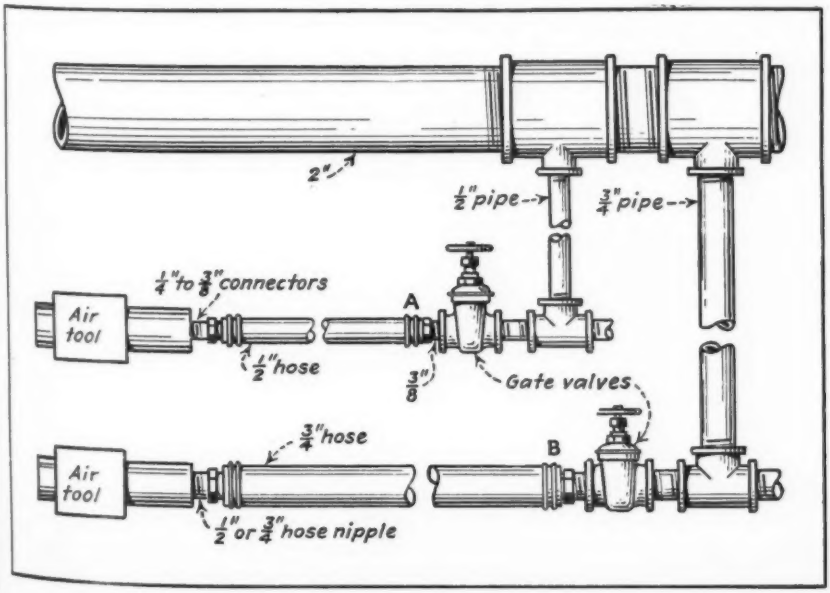
Correct Pressure Increases Air-Tool Efficiency

A FEW YEARS AGO we encountered some cases where plants were not getting full power out of their air tools and found that the air lines and hose were too small. In one plant a 2-in. pipe ran along the ceiling with ½-in. drops to the floor. A gate valve and two ½-in. hoses connected to the end of each pipe. In each end of the air hose a pipe nipple reduced the opening to about ⅜-in. and on some to ¼-in. The hoses, repaired at one or two places, had a few more nipples at these spots. Tools used included an assortment of 6- and 8-in. air grinders and chipping hammers.

We demonstrated a new 8-in. air grinder and noticed the tool seemed to lack power. An air gage connected to the entrance hole in the grinder handle showed a pressure of only 50 psi when the tool was working with 92 psi at the compressor. The grinder did only about half the work it was capable of doing if proper size hose, pipe and connections were used. We installed a ¾-in. hose with correct-size nipples at each end near the compressor where we could hook right to the 2-in. pipe. Then the tool did about twice as much work, with no extra effort on the operator's part.

Since then I have checked compressed-air pressure at the tools in many plants and have found it low in most of them. Metal removal with grinders has been increased as much as 66% in some cases by installing the right size pipe and hose. In some cases after piping, hose and couplings had been increased to the proper size it was not necessary to invest in new air tools as had been intended before the change was made. The diagram shows wrong and correct air-line connections, at A and B respectively.

A study of the reasons for using ½-in. hoses and ½-in. pipelines shows that in most plants the engineers expect to use but one tool, but later add more without increasing the pipe size. The average air grinder for 6- and 8-in. wheels has a ⅜-in. hole for the air, but some



of the newer ones have a ½-in. hole. Various makes of chipping hammers and tampers have a ¼-in. hole. When a plant is using all three sizes, it is quite general practice to equip the air hose with a nipple to fit the smallest tool. Then, for the nipple to fit the larger tools a reducing bushing is inserted in their air hole, whereas, the hose and couplings should be bought to fit the larger tools and the smaller ones adjusted to take the same connection. Years ago some plants found that a ¾-in. air hose was too large and bulky for portable tools and to meet objection from operators went to a ½-in. hose. This objection no longer exists because light-weight ¾-in. air hose light, flexible and tough enough for all purposes is available.

Paper presented in the "Compressed Air in Industry" contest sponsored by the Compressed Air Institute.

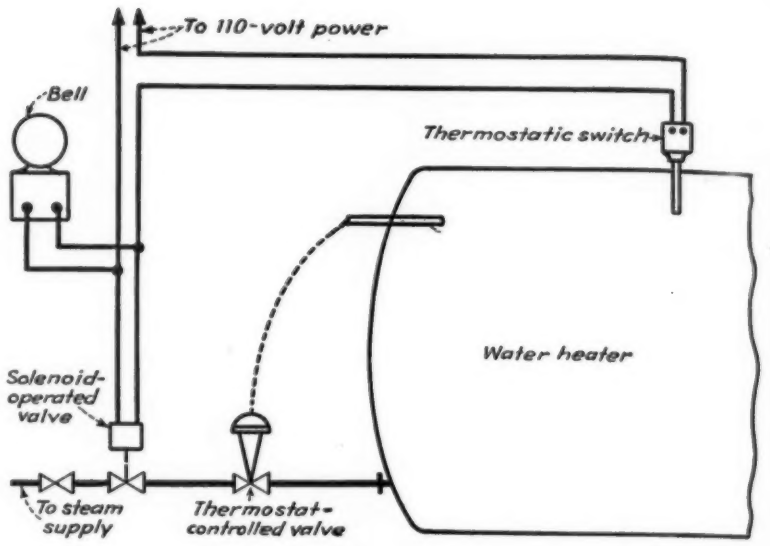
Chicago, Ill. DON A ROW

Make Safety Guard Permanent

WE PROVIDED DOUBLE DOORS near one end of our power station to permit handling equipment in and out of the plant with an overhead trolley. A pump, the last unit in the plant, was set in a pit low enough below the door to permit lifts to pass over it. When the doors were opened for station ventilation, there was danger of someone walking in through them and falling into the pump pit. The usual way of preventing this was to stretch a chain across the opening.

Chains have a way of being unhooked when they should be hooked and failing to give proper protection. We therefore decided to eliminate the human element entirely by installing a ¾-in. pipe across the doors, held in a socket screwed to the door frame, as at *A* in the photo. This barrier cannot be dropped without taking out the screws, and so cannot be accidentally removed. Being positioned on the frame clear of the doors when they are closed, there is no reason for removing the pipe barrier except when some large part is being taken out or into the plant, which is seldom. This makes the guard practically permanent.

Houston, Texas CHARLES C LYNDE



Alarm Safeguards Hot-Water Temperature

ANY PLANT SAFETY PROGRAM that fails to include within its scope supervision over the control of domestic hot-water temperatures is overlooking a frequent source of serious and sometimes fatal injuries to personnel. Numerous cases are on record of scalds caused by washroom or shower-bath water being excessively hot, accidents which might have been avoided had some effort been made to prevent hot-water temperatures from rising above safe limits.

Most hot-water temperatures are controlled by thermostatic valves or similar devices, but unless such devices are carefully maintained and their settings checked at frequent intervals they cannot be depended upon. Permanently installed thermometers may become inaccurate and should be checked.

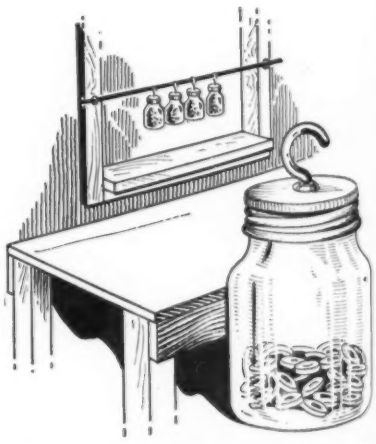
To remove the possibility of dangerous hot-water temperatures in our plant we installed a solenoid-tripped valve in the steam line in addition to the usual thermostat-controlled valve. The solenoid-tripped valve is opened by hand against the tension of a spring and latched open. Its coil connects to a normally open thermostatic switch installed in the top of the tank, as in the diagram.

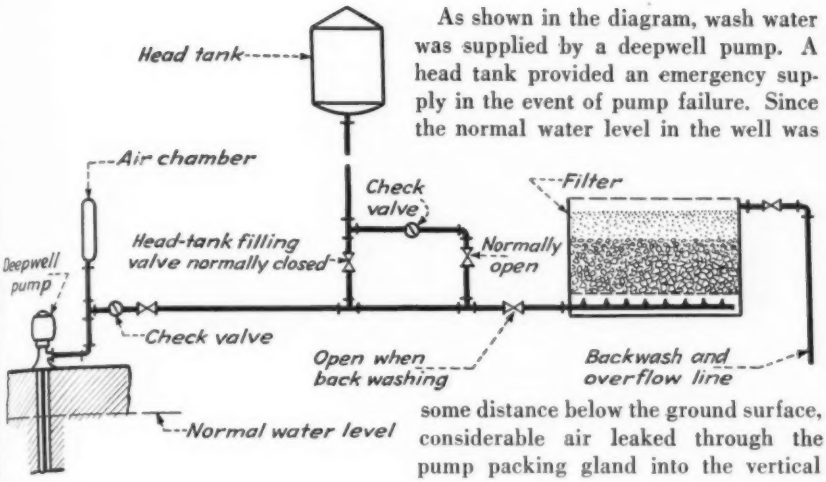
The thermostat on the valve switch is set for about 10 F above the one on the control valve. If the steam-control valve fails to function properly and the water temperature goes 10 F above normal the thermostatic switch closes and trips the solenoid valve and rings the alarm bell. Steam cannot be supplied to the water heater again until an attendant resets the solenoid operated valve after the water temperature has returned to normal.

Lynchburg, Va. O M ROBERTS

Glass Jars Make Handy Small-Part Containers

MANY SCHEMES have been used by mechanics for storing screws and other small parts so that they would be at hand when needed. The drawing shows my way of doing the job. In the center of the covers of small screw-top glass jars I solder a hook so that the





Air Chamber Cures Filter-Bed Troubles

OF ALL THE FACTORS affecting stability of gravel filter beds none is more important than backwashing to remove the solid material strained out of the filtered liquid and held by the finely divided filtering sand.

Backwashing troubles are primarily caused by improper distribution of backwashing water under the filter bed producing high flows over small areas of the bed, or entrance of large volumes of air with backwashing water. In either case there is always danger of rupturing or causing boils in the sand layer, which will cause the filter bed to have uneven thickness and poor filtering efficiency. While control of water distribution under the filter bed is a matter of proper piping design, preventing the admission of air is not so simple and frequently requires considerable engineering ingenuity, as indicated by the experience in a large industrial filtration plant.

As shown in the diagram, wash water was supplied by a deepwell pump. A head tank provided an emergency supply in the event of pump failure. Since the normal water level in the well was some distance below the ground surface, considerable air leaked through the pump packing gland into the vertical section of the pump discharge pipe in the well when the pump was shut down after each backwashing operation. When the pump was started up again this air was forced out and up through the filter bed, disturbing its condition.

Numerous venting arrangements were tried to get rid of the air before it reached the filter but none proved entirely successful. Finally it was decided to install an air chamber just ahead of the pump check valve, as in the diagram, which solved the problem. This chamber was made sufficiently large to contain all the air in the well piping when the pump was started, when the air was compressed to the pressure required to open the check valve. This air remained in the chamber until the pump was shut down and then expanded back into the well to be recompressed when the pump started again.

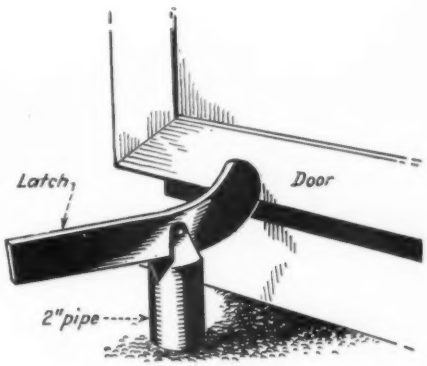
Stanton, Va. S H COLEMAN

jars can be hung by their top on a rod supported back of my work bench. They are then away from danger of being knocked or jarred off a shelf yet convenient when needed. The contents of the glass containers can be readily identified.

Penacook, N. H. C H WILLEY

Automatic Latch for Pumphouse Door

WE MADE AUTOMATIC LATCHES to hold our pumphouse doors open, as in the figure. A support for each latch was made from a length of 2-in. pipe swaged to a conical form at one end. We divided this cone in the center with a slot



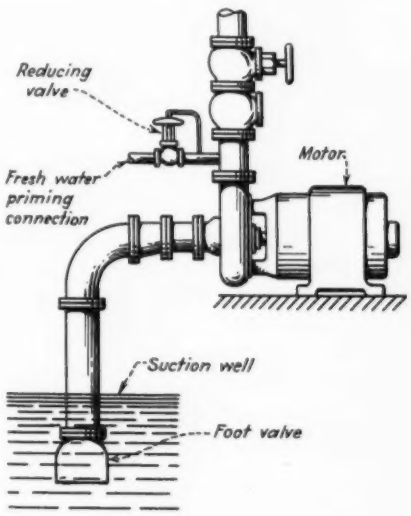
for the latch, shaped as shown. A bolt through a hole in the latch, about two-thirds its length from one end, supports the latch in the top of the post, set securely in the ground.

When the door swings open it hits the top end of the latch and swings it down. When the door clears, the latch drops to the position shown and locks the door open. Being self-actuated and set near the building, the latch neither requires attention to insure its operation, nor does it interfere with full use of the door.

Houston, Texas CHARLES C LYNDE

Reducing Valve Keeps Sump Pump Primed

WE INSTALLED an end-section, single-stage, centrifugal sump pump in an unattended automatic pumping station to operate against about a 6-ft static suction lift. This pump, started and stopped automatically by a float in the sump, handled a mixture of fresh and sea water that built up a slimy deposit and kept the foot valve from seating drop-tight. Because the pump operated at the end of long shutdown periods only a small leak through the foot valve caused a loss of prime.

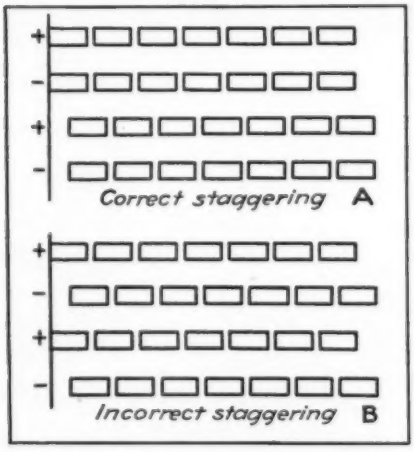


To insure that the pump would remain primed we made a ½-in. connection from the fresh water main into the pump discharge. In this line we connected a ½-in. reducing valve, as in the figure, set to let water flow into the pump if discharge pressure dropped below the static discharge head on the pump. Thus the reducing valve supplied the water, lost by leakage through the foot valve, to the pump. When the pump is operating it develops a pressure above the reducing-valve setting and this valve remains closed. We found that about one gallon of water per hour keeps the pump primed when it is shut down. This water leaks through the foot valve into the sump and is removed by the pump with the drainage.

St. John, N. B. C S CLARK

HOW TO SPACE BRUSHES ON COMMUTATORS

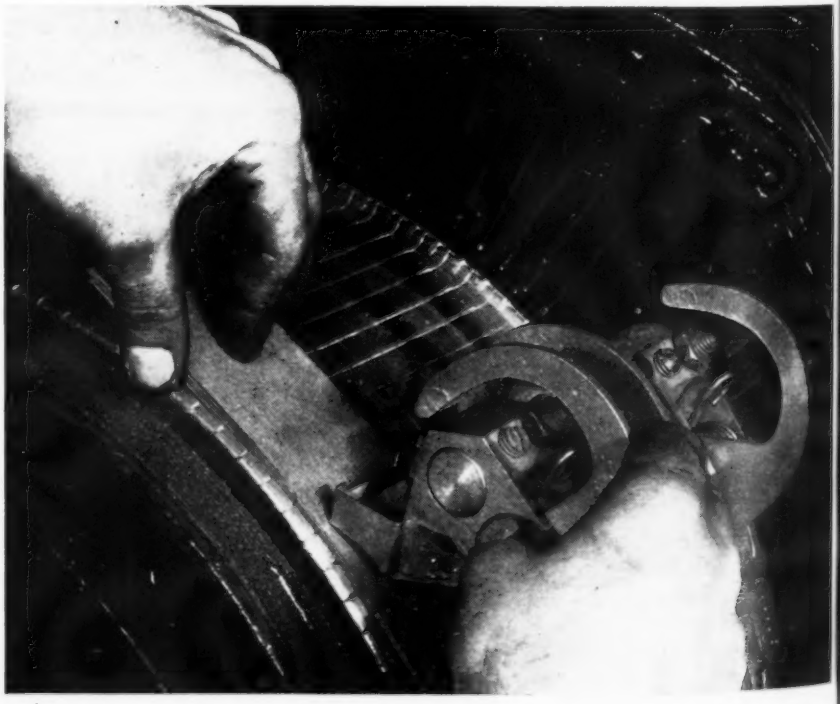
1 To obtain first-class commutation on direct-current machines, brushes must be carefully spaced around the commutator and set at the proper angle. The studs that support the brush holders must be carefully set, not just tightened in place and allowed to come where they will. Inaccuracies in the different parts of the brush rigging may accumulate in some cases and cause a considerable error in the stud alignment with the commutator. Therefore, first determine the approximate distance of the studs from the commutator to give correct angle of the brush holders when they are set about ⅛ in. from the commutator. Check the distance between each end of the studs and the commutator with inside calipers. If a stud is not parallel with the commutator correct its alignment with paper shims back of its insulators



3 Setting of brush holders with relation to the commutator varies slightly with brush-holder type, but in all cases the holders should be set equal distances from the commutator. Usually this distance does not exceed ⅛ in. For a gage use strips of fiber to obtain the proper thickness. Place the gage under a brush holder, loosen the set screws or clamping bolts, move the holder down until it rests firmly on the fiber and then securely fix the holder in place. Repeat this operation on all holders. If work is started with the brush rigging dismantled, manipulate the adjustment of one brush holder and its stud until the desired angle of the brush on the commutator is obtained. Then set all the others the same. If the wearing face of the brushes has been cut to the proper angle, adjust one holder and its stud until the brush face is tangent to the commutator, when the holder is about ⅛ in. away. Use this setting as a guide for the other

(Photos by courtesy of the General Electric Co)

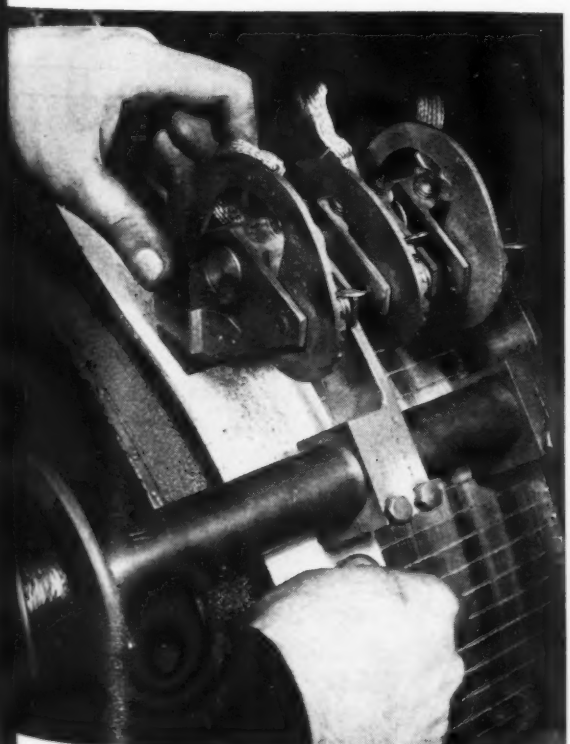
2 Stagger the brush holders on pairs of studs so that the brushes on one pair ride on the space between brushes in an adjacent pair, as at *A*. This distributes brush wear across the commutator. Brushes of the same polarity should not track each other, as at *B*, because wear on the commutator when current flows from brushes to commutator differs from wear when current flows from commutator to brushes. On 4- or 8-pole machines correct brush staggering is done as at *A*, but on 6-pole set two pairs of brushes as at *A* and one like *B*



To check accurately the brush spacing place a strip of paper tly around the commutator and rk it to the exact commutator cir- nference. Remove the paper and urately divide the circumference gth into as many divisions as there brush groups. Draw a line square- across the paper at each division, guide in locating the brushes. After studs and brushes have been set urately it might seem reasonable expect that if the brushes were put the holders they would be correctly ced around the commutator. How- r, this may not be true; slight in- uracies in the brush rigging may accumulative and cause an error the brush spacing. Also, counting number of commutator bars and iding them into as many equal oups as there are brush-holder studs not be used as a guide to check brush spacing, because the com- tator bars and the insulation be- een them may vary in thickness

Put the brushes in their holders and fit them to the commutator with medium sandpaper. On the final fit ll the sandpaper in the direction of commutator rotation. ct time the sandpaper is pulled, lift the brush and turn the sandpaper to its original position for another ll. Continue until the brush face makes a good fit h the commutator curvature. Do not use fine sandpaper fit brushes. Experience shows that a better fit can be tained by using a medium-coarse grade, because it es not clog with carbon as do the fine grades. Brush can be improved after using the sandpaper by applying rush-seating stone. After the brushes have been fitted, an them and the brush holders

6 Remove the outer brush in each group. Put the marked strip of paper around the commutator again and secure its ends with glue or scotch tape. Set the brush holders so that the brush toes will be back of the marks, put the brushes into their holders and move the toe of one brush to its mark. If the brushes are equally spaced all the other brushes should toe their marks. If some of them do not, loosen their brush holders and move the holders up or down slightly to give correct spacing. When a set of brushes is too far out of location it may be necessary to correct the stud position. When the brushes are properly spaced, check each brush group to see if the toes line up with the edge of the same bar



READERS' PROBLEMS

Questions from Our Readers

Needs Fuel or Heat Storage

Question 1

I HAVE AN HRT BOILER *72 in. by 18 ft which we ordinarily fire with oil. For a period of six hours during each day we dispose of asphalt fumes by burning them under this boiler. They are supplied to the boiler at 500 F and 3 psi by a blower. When using the fumes for fuel the oil burner is adjusted to maintain only enough flame to ignite the asphalt. To keep the steam pressure down requires bleeding steam through a 2-in. line, usually wide open, into a large concrete pit of water.*

During the remainder of the day we use very little makeup water so it is impossible to utilize the heat discharged to the condensing tank water. Is there any way that we can store this steam or the asphalt fumes to allow operation without wasting steam? If storage is impossible how can we dispose of the excess fumes above the amount needed for ordinary load conditions—HEF

Maintenance of Chain Drive

Question 2

We have several chain drives in our plant, some being of the so-called silent drive and others of the roller type. What is the best method of checking the alignment to obtain the best service from these drives? What allowance must be made for tooth wear to prevent the chain from riding or jumping pinion teeth?—AGF

Steam for Water Heating

Answers to Dec Question 1

The Question

IN OUR HOT-WATER HEATING SYSTEM *we use 150-psi steam to supplement low-pressure steam for heating the water. The circulating pumps handle 3000 gpm for plant heating. We supply the live steam through a 4-in. line to a T-shaped manifold. From here six lines varying from ¾ to 2½ in. carry the steam to a blank flange in the end of the l-p header. This arrangement is objectionable because it produces considerable noise during extremely cold weather when it becomes necessary to open all of the supply valves on the manifold.*

Would the system efficiency be lowered if we reduced the live steam to 65 psi before admitting it to the l-p main? Would this eliminate some of the noise? Could this system be improved by installing a 4-in. automatic reducing valve for live-steam-flow regulation?—CH

Install Double-Coil Heat Exchanger

ASSUMING THAT THE PIPING is arranged approximately as shown in the sketch and that the purpose of the six lines of various sizes is to provide a means of close regulation, the high-pressure steam might conceivably build up full pressure (150 psi) throughout the entire low-pressure system and cause considerable trouble.

One way to remedy this situation would be to install an automatic pressure-regulating valve at *A* to maintain same pressure at *B* as is usually obtained when plenty of exhaust steam is available. This should be supplemented by an automatic thermostatically controlled valve connected in series to prevent the water from becoming too h
If there is not sufficient hot water fr
this arrangement, an additional h
exchanger supplied with high-pressu
steam could be installed as a booster.

Another method would be to inst
a heat exchanger with two coils,
for low-pressure and the other for hi
pressure steam, with an automatic th
mostatically controlled regulating va
on the high-pressure line.

Over-all system efficiency (includi
safety factors) would be improved
reducing the pressure.

Barto, Pa. J T WEST, JR.

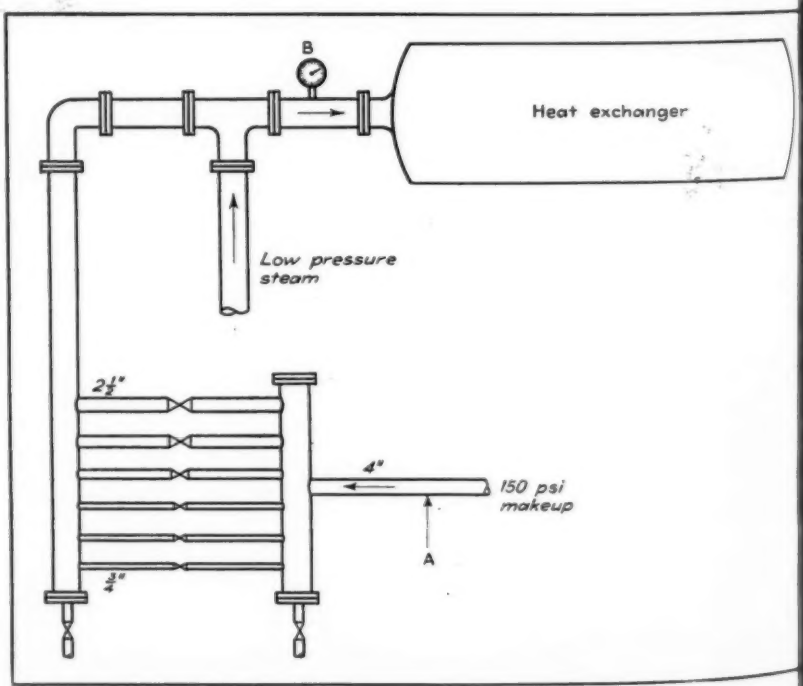
Low Pressure Requires Larger Pipe

WITHOUT COMPLETE DATA as to t
quantities of steam, heat, sources, a
alternative uses in CH's problem it
impossible to give the most efficie
water-heating cycle.

It is unlikely that lowering the liv
steam pressure to 65 psi would impro
results, but such a change wou
necessitate increasing pipe and val
sizes to 6 in. because of the increase
steam volume.

It is suggested that a single 4-i
valve of modern streamlined design f
throttling service be installed with
least an 8-in. and preferably a 10-i
pipe connecting the valve to the l

(*Continued on page* 118)



It's the difference between a rifle and a shotgun

All of us today are trying to do more with less. Power plants, manufacturers, everybody. Like sharpshooters, we have to make every shot count.

Most power plants have to produce more power, with replacement condenser tubes restricted to a fraction of the original surface. One way to widen this slim margin of safety is to be sure that all new tubes are of the utmost mechanical perfection, are produced by master metallurgists.

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header. If some flow at all times is permissible a balanced valve can be used, but if tight seating is essential a single-seated valve with V-ports and plug to reduce wire drawing is recommended.

This 4-in. valve can be automatically controlled by a pneumatic or hydraulic pilot valve actuated from the l-p header pressure if variations in operating conditions justify this additional expenditure. This is a question of total cost of manual against automatic control; thermal efficiency will not be materially affected.

Some noise in such an installation is inevitable but it will be reduced to a minimum if the reducing valve is located close to the l-p header and connected thereto by a large pipe.

St John, N. B. C G CLARK

Use Air-Operated Control

NOT KNOWING THE TYPE of heater in CH's installation, or the source of the l-p steam, and assuming that the heater can handle the load, as seems to be the case when h-p steam is admitted through the different size lines, I would suggest the following hookup (1) For steam control: install a pressure-reducing valve in the h-p steam line, reducing the pressure to 65 psi, to eliminate the possibility of creating a backpressure in the l-p line which may be fed from an extraction turbine or some other euipment. (2) For temperature control: install a valve in the steam line entering the heater, operated by a diaphram or bellows mounted on top of the valve and controlled by water temperature.

If low-pressure air is available in the plant I would suggest a "Johnson" or "Powers" control with modulating-type thermostat mounted on the heater as near the hot water outlet as practical, this instrument actuating the l-p steam valve by air pressure; or a temperature control of the conventional type, consisting of capillary tube and bellows, actuated by expansion and contraction from temperature changes, as shown in the illustration.

Bogota, N. J. FRED MEYER

A 4-in. Line is Sufficient

NO MENTION IS MADE of the drop in temperature of the circulating water, but assuming a 10-F drop in the system, at the rate of 3000 gpm the heat transfer will be 15,000,000 Btu per hr. The available heat should be at least 900 Btu per lb, considering some cooling of the condensate. Therefore 13,333 lb of steam per hour at 150 psi would be required.

A 4-in. line will supply 17,000 lb per hr and a 3-in. line 9500 lb per hr. I would recommend installing a temperature regulator in the h-p steam line of such size to supply the necessary makeup. By adjusting the regulator to the desired temperature the makeup steam will be automatically controlled by the desired final water temperature.

Such a device would obviate the necessity of constantly watching the temperatures and adjusting a multiplicity of valves.

Scarsdale, N. Y. H P WILDER

Requests More Detail

POWER READERS MUST HAVE wasted considerable time trying to analyze CH's problem before submitting a positive suggestion for his predicament, becau only a few of the details were stated.

In this particular problem CH speaking of heating and circulation hot water, l-p steam and h-p steam. A sume that the water for plant heati is heated through a heat exchang where is the economy? Perhaps he co siders a conversion from the present boiler to a hot water generator, whi would eliminate supplementing steam from the h-p system and con quently solve his problem. Or do he inject live steam into the wate This of course would produce consi erable noise. CH's trouble originat from steam meeting condensate or wat in that particular header and it shou not require engineering skill to reme this situation.

Schenectady, N. Y. CARL BACHMAN

Investigate Other Sources of L-p Steam

THE EFFICIENCY of CH's heating syste would not be lowered but would b improved by passing the live stea through a reducing valve because th l-p steam becomes superheated.

At present the objectionable nois caused by the h-p steam condensing, similar to the result one might expe from feeding cold water into the stea drum of a boiler, and should be disco tinued as soon as possible. This hi and-miss system of having several size lines running from the header may hav been the best in an emergency or as makeshift.

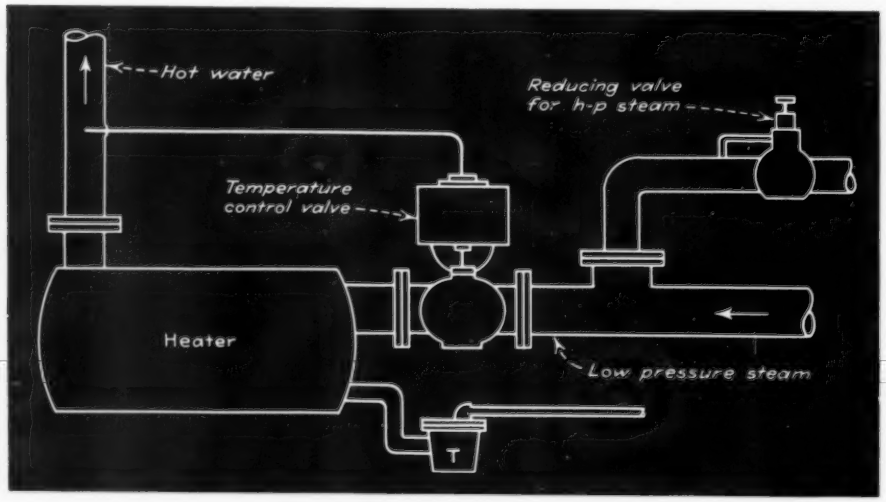
Before installing a reducing valve may be found possible to run a bleede line from some other part of the plan equipment, between the stages of turbine, from the valve chest of a com pound reciprocating engine or possibl from some process where exhaust stea is available.

If necessary, after these sources hav been tapped I would install a reducin valve on the h-p line but before doin so I would study the data pertaining the demands of this heating syste What are the maximum and minimu requirements? What is the range temperature between the flow and r turn water? Submit all this data reducing-valve manufacturers and the will advise as to what type and size valve should be used.

Avoid using a valve that will giv trouble when the minimum demand so small that the seat and disk soon b coming grooved are a source of con stant trouble.

It may be advisable to fit a therma

(Continued on page 120)



128 YARWAY IMPULSE TRAPS at St. Croix Paper Co.

WINTERS are really cold in Woodland, Maine, up on the Canadian border, but Yarway Impulse Traps handle the heavy condensate load with dispatch at the St. Croix Paper Company Plant. 128 Yarway Impulse Traps are in use at this plant — draining unit heaters, air preheaters, steam mains and other equipment.

More than 180,000 Yarways Have Been Sold . . .

. . . purchased on their performance. Users report that *quicker heating* and *greater sustained heating efficiency* soon pay for their installation and continue to return worthwhile profits in plant operating economy. Then, too, the Yarway Trap's *small size saves space.* Its *light weight simplifies installation.* Its unique design with *only one moving part,* and its *rugged bar-stock construction,* keep down maintenance expense.

Good for all pressures over wide range without change of valve or seat — it may be used on any constant or fluctuating pressures.

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YARWAY IMPULSE STEAM TRAP

controlled valve on this system operated by the heating water temperature.

Kearny, N. J. GEORGE MCNALLY

Choose the Correct Valve

THERE APPEARS to be no objection to CH reducing the pressure of the high-pressure steam through a reducing valve to 65 psi or even considerably less. When steam passes through a reducing valve, some drop in steam temperature occurs, but no loss of heat, except a slight theoretical loss which is so small as to be negligible in practice.

After passing through the valve the steam will be superheated at the lower pressure, but as the l-p steam used for heating, will, no doubt, be somewhat wet, the superheat will be taken up in reevaporation, which should be an advantage. It would therefore appear that there will be no noticeable efficiency loss in reducing the pressure of the 150-psi steam.

With regard to the size of the reducing valve, it is always desirable to use a valve of such a size that it will operate, as nearly as possible, full open, most of the time. A partially closed valve leads to wire-drawing, poor regulation, and seat destruction.

The best plan, if possible, is to obtain manufacturers' data on the operating capacity of the valve. In the absence of this, it is generally safe to install a valve half the size of the high-pressure line. We are, after all, after a loss of pressure, and we need not mind if this is partly caused by the added friction of a small valve.

Bloomfield, N. J. J O G GIBBONS

What Causes Grate Burning?

Answers to Dec Question 2

The Question

OUR 554-HP BOILERS *are equipped with twin chain-grate stokers. We have just finished replacing an 18-in. strip down the center of each grate, the only part of the grate area damaged.*

We use ordinary mine run fairly high-volatile screened coal with the ash content running approximately 12%. Induced draft fans supply draft and the boilers operate at 150% rating.

Can POWER *readers suggest reasons for this grate burning and remedies to prevent it reoccurring?—CAM*

Make Allowances For Grate Expansion

CAM'S GRATE-BAR TROUBLE appears to be caused by insufficient air spaces in the grates, or the grates when installed may have been too neat a fit, leaving insufficient room for expansion. This condition causes warping, burning and cracking of the grates which in a short time have to be removed.

Another cause of burned grates results from hot ashes in the ashpit which burn the grates on the bottom. This condition also may be caused by the grates being made from a poor grade of cast iron.

I suggest that CAM check the air spaces in the grates, which in his case should be between 30% and 40% of the total surface. He should also make sure that there is ample room for expansion of the grates.

New York, N. Y. JAMES DALY

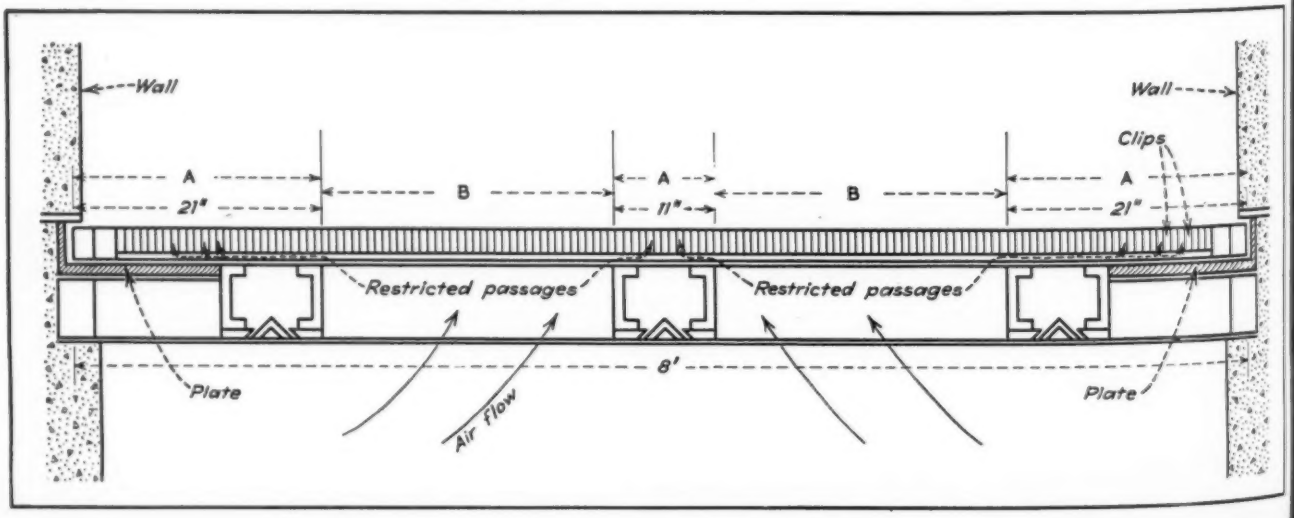
Scraper Removes Clinker

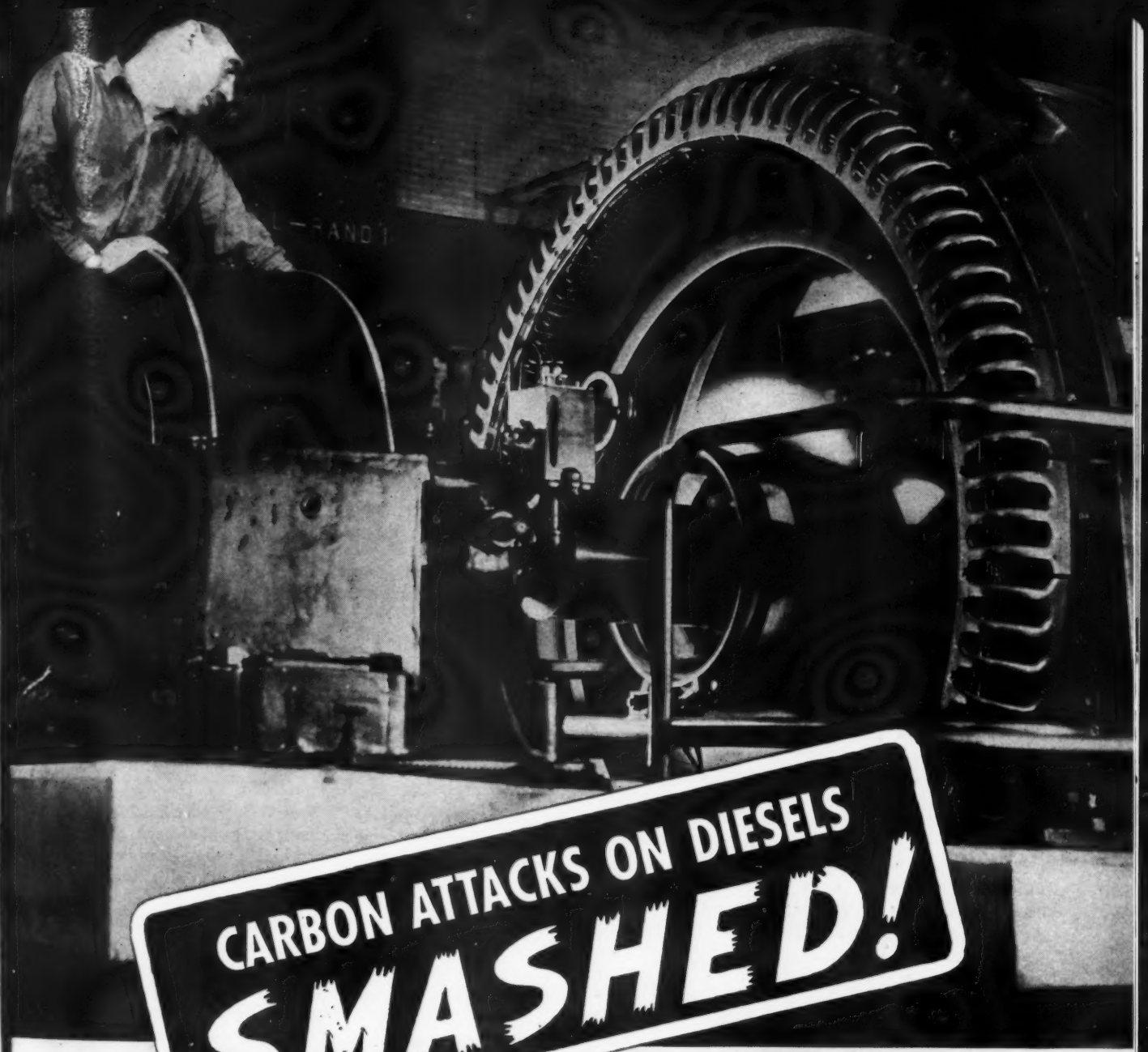
CAM'S PROBLEM OF STOKER clips burning is one that may require considerable work to eliminate. As we have the same trouble with burned clips, he may benefit from our conclusions as to what causes them to burn and what can be done as a preventive.

The sketch will give a rough idea of our stokers, showing the sections that burn. These sections always burn the same and each section is very sharply and plainly distinguished at the edge of areas marked. The sections that burn are marked *A* and those marked *B* do not burn but stay in fair condition except for the clogging of the air ports in the clips.

It will be seen that the air must flow between the grate and chain links and supporting parts under the sections marked *A*. Under the section marked *B* the air flows freely and straight through the grates or clips because there is no ironwork between the grates and the open air duct, while under the sections marked *A* the air flows lengthwise of stoker bars between the clips and the supporting ironwork. As the clearance between the clips and this ironwork is about one inch, the air and the parts of the stoker become much hotter and other ironwork gets much hotter than the sections marked *B*. Another thing that raises the temperature of the clips is the heat from the furnace walls which radiates down through the clips striking the ironwork underneath and making both the ironwork and clips hot

(*Continued on page* 122)





CARBON ATTACKS ON DIESELS SMASHED!

SOLNUS OILS

"Solve carbon problem . . . eliminate fire hazard"

For 10 years the generator-connected diesels in a large plant manufacturing electrical controls were plagued with carbon. Numerous high-grade lubricants were tried—all resulting in the same trouble. Carbon accumulated to such a point that forced shutdowns occurred on an average of once every 60 to 90 days, causing serious trouble and power losses.

Then a Sun Oil Engineer—a diesel lubrication expert—recommended Solnus Oils. They solved the carbon problem . . . stopped numerous shutdowns and fire hazards . . . ended costly power interruptions.

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enough to oxidize them each time they pass through the furnace. When the clips are new this oxidation is slow but when exposed repeatedly they will burn much faster and at lower temperatures. Clinker formation on the clip surface will accelerate the clip burning. Also when the air ports of the clips clog up, clinkers will form easier and the temperatures will be higher than when the air passages are clean.

We have found that corrosion and ash oxidizing on the clips, after a few months of operation, requires the removal of one or more clips to give clearance between the clips and the furnace walls to keep the stoker from sticking or dragging too heavily. In observing the results of changes made, to determine why the clips burn, it has been found that whenever too many clips have been removed or too much clearance permitted between the clips, that the clips have burned much faster at sections *A*. Too much clearance at sections *B* (page 120) seems not to make any difference as these sections never show much damage from burning.

Clearance at sections *A* allows the heat from the furnace to radiate through the clips faster and probably raises the temperatures much higher than before removing the clips. It has also been observed that the ironwork under the sections *A* operate at higher temperatures than under sections *B*.

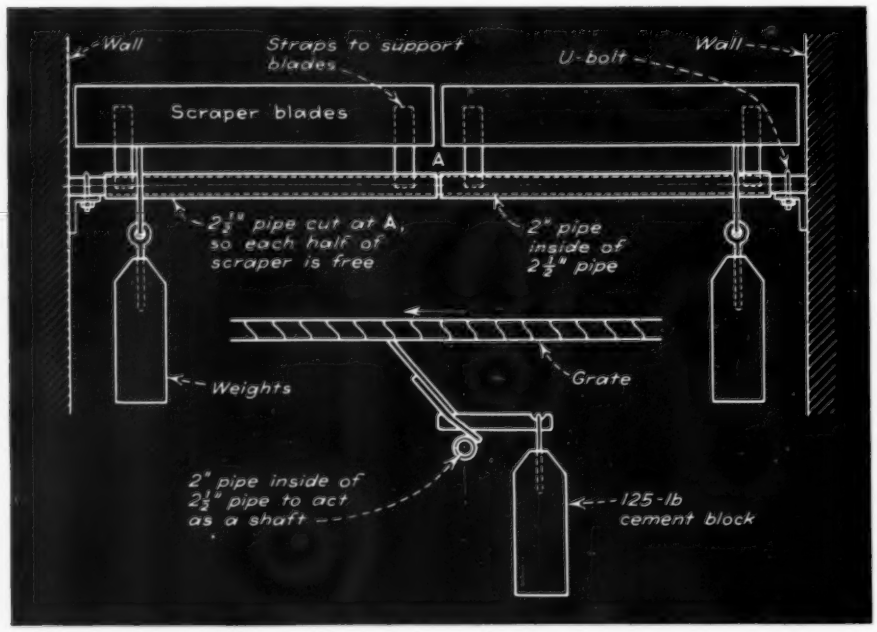
Clip burning also results from banking a boiler too soon after operating under a high rating, or from shutting off the draft too soon under the grates with the grates still extremely hot from operation.

The boiler should be banked slowly to give the furnace and grates plenty of time to cool. Run the fuel bed out further in the furnace to cover the grates wherever the heat may be radiated back from the furnace walls to the grates. Open the air ducts so that cool air can enter the ducts under the grates. The temperature of the preheated air could be lowered, which in turn would help to cool the grate somewhat. This will also lower the boiler efficiency, which may not be desirable.

The furnace could be operated with a longer fuel bed so as to cover a larger section of the grates. This will interfere with heat radiating from the walls and striking the grate surfaces. Operate the furnace with lower CO_2 by admitting more air to the fuel bed and more under the grates out in the zones beyond the end of the fuel bed. This will lower the temperatures of the furnace and the grates.

Prevent clinkers from forming to the grates and keep the air ports of the clips clean and free so air can pass through freely. To remove the clinkers from the grate surfaces we constructed scrapers, see sketch below, under the returning side of the grate to scrape off the clinkers, which then dropped down to the pit beneath. Two of our boilers have been equipped with these scrapers and they have been doing a good job of cleaning the stoker clips for the past nine months.

Bismark, N. D. LESLIE BRADLEY



Make A Complete Fuel Analysis

CAM SHOULD HAVE described his operating practices in the handling of the twin stokers in more detail. How thick is the fuel bed carried? How far does he let the fire go beyond the ignition arches? Do red hot coals fall into the ash pit?

How much excess air is he losing at the sides of the chain grates through the fuel bed? How much overfire draft does he carry over the fuel bed. How much CO_2 does he carry? What position are his stack dampers in? Are all the operators thoroughly familiar with the stoker equipment?

The condition is probably caused by the center of the grate receiving the brunt of ash fusing, clogging up the grates, causing a large amount of excess air to be drawn through burned out spots. Some parts of the grates then will become dirty and overheated, causing early deterioration.

It must be understood that chain grates are limited in combustion rate in accordance with the overfire draft, and if induced draft is used, as in this case, the combustion rate, which is also governed by the fuel bed thickness and the speed the grate travels, cannot, because of lack of agitation, be as high as that of an underfeed stoker. CAM should also check the boiler arches, windboxes, and the draft characteristics through the fuel bed.

Good engineering also calls for making a complete analysis of the fuel used, and for thoroughness, complete data should be kept of all coal delivered to the plant.

For a given boiler capacity, fuel-bed thickness is determined by the characteristics of the fuel in question, such as the ash content, fusing point, and coking qualities of the coal; to say that a certain thickness of coal may be carried at all times is very misleading.

Coals that have a uniform sizing are considered excellent for good firing. Fuels that have much light screenings or dust mixed in with larger sizes will call for a large amount of draft.

Fairview, N. J. M N GOZDENOVICH

Sudden Banking Traps The Heat

WHEN A HEAVY BED OF FUEL is burning on a chain-grate stoker and the draft is suddenly cut off, as may occur in banking or with automatic draft control and a sudden drop in load, the heat usually

(Continued on page 138)

Keep 'em Firing with N

AMERICA needs to keep firing on the industrial front as well as on the War front—24 hours a day every day. The inspiring production record of American Industry has been made possible by equally inspiring steam generating capacities. New production records can and will be established if we get the most out of our power plants.

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How to Figure Linkages

By PHIL SWAIN

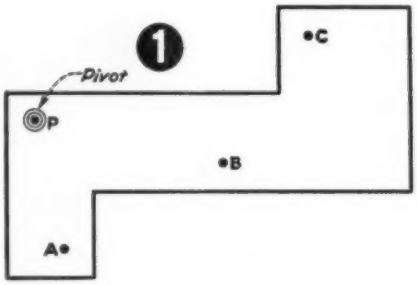

Fig. 1—Piece swings around the pivot *P*. What is direction and velocity of movement of points *A*, *B* and *C*?

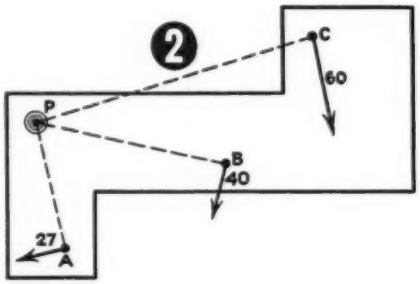

Fig. 2—Each point moves at right angles to its radius and with a velocity proportional to the radius (points farther from pivot move faster)

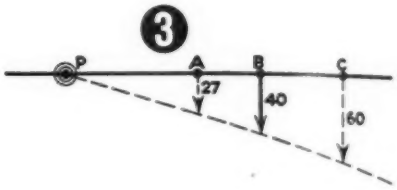

Fig. 3—Construction for drawing velocity arrows proportional to radius is based on law of similar triangles

SUCH LINKAGES as are found in valve mechanisms are interesting studies, and easier to figure than some imagine.

First you have to understand how points move in a single pivoted piece. In the rigid irregular piece, Fig. 1, *P* is the pivot. Consider how *A*, *B* and *C* move when this piece turns clockwise. Draw the radii *PA*, *PB* AND *PC*, Fig. 2. Each point will move at right angles to its radius, and its velocity will be in exact proportion to that radius.

The arrows in Fig. 2 are drawn in this proportion, and correctly represent the velocities of the three points. If the velocity of *B* is known to be 40 fpm, that of *A* will be 27 and of *C* will be 60. Simplest way to determine velocities of *A* and *C*, if *B* is known is to use the triangle construction shown in Fig. 3, where *PA*, *PB* and *PC* and the 40 fpm velocity of *B* are laid out to scale.

In the simple 3-bar linkage of Fig. 4 and 5, link *AB* has the fixed center *A* and link *CD* has the fixed center *D*. Link *BC* has no fixed center, but at each position it has a temporary or *instantaneous* center. To find this instantaneous center we must first locate the direction of motion of two points in the link *BC*.

Use Points B and C

The two points to use are *B* and *C*. We already know the motion of *B* because it is in *AB* as well as in *BC*. It is clear that the instantaneous center of *BC* must lie along *AB* extended, because *AB* is perpendicular to the motion of *B*. Motion is always perpendicular to a line from the center of motion to the moving point. By the same reasoning the instantaneous center lies along *DC* extended. Hence it must lie at the intersection, as shown in Fig. 5.

Now if the velocity at *B* is known, that at *C* must bear the same ratio to it as the radius *IC* bears to the radius *IB*, exactly as in Fig. 2.

Fig. 6 diagrams the crank, connecting rod and crosshead of a steam engine. Crank speed is practically constant. Crosshead speed varies from zero at each end to a maximum at some intermediate point. If crankpin speed is constant at 1000 fpm, what is crosshead speed at the given crank position?

Note that the dotted extension lines are at right angles, respectively, to the motion of the crosshead and the crank, so the instantaneous center must lie at their intersection. The crosshead velocity arrow is drawn proportionate to its radius on the same scale as the crank velocity arrow.

These methods can be applied to many other combinations of cranks and slides.

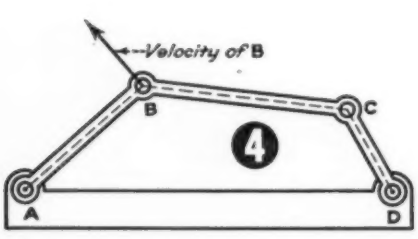

Fig. 4—Knowing velocity of *B* in this simple linkwork, problem is to find velocity (direction and speed) of *C*

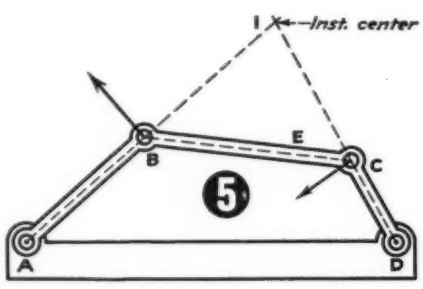

Fig. 5—Instantaneous center must lie on lines perpendicular to known velocities of points *B* and *C*

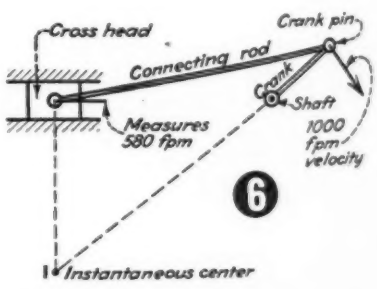

Fig. 6—Given 1000 fpm crankpin velocity, crosshead velocity is found to be 580 fpm by this construction

A Report on The Steel Valve Outlook

"What's the 1943 delivery picture for steel valves?"
"How can I get quicker shipment?"
"How long am I going to be able to get repair parts?"
"How will valve material substitutions affect me?"

Culled from the mail, these are the kind of questions which prompt this simple, straightforward report on the wartime activities of The Edward Valve & Mfg. Co., Inc.

Here are the facts.

What About Deliveries?

War needs for steel valves have, of course, increased during the past year. Nevertheless we have tried not to bite off more than we can chew. We have tried to set delivery schedules based on facts, not hopes.

Since critical materials are used in the manufacture of steel valves, limitation orders, directives and revised preference ratings have occasionally resulted in minor delivery changes, but *on the whole, we have been ahead of schedule throughout the past year.*

During 1943 we intend to follow a similar policy. We are serious about keeping or bettering delivery promises.

How About Repair Parts?

When a valve user orders a repair part he usually needs it in a hurry. Therefore we put particular emphasis on delivering parts quickly. *At the close of 1942 there was not a single past due repair part order on our books.*

Orders for maintenance parts are naturally increasing since old equipment must last for the duration in many plants. To help keep these plants running we will continue to give preferred treatment to repair part orders, within the limitations of government regulations, of course.

Simplification Cuts Inventories, Speeds Shipment

The war has brought much voluntary valve standardization and simplification. The user, the distributor and the manufacturer are all gainers.

For years Edward engineers have designed for maximum part interchangeability. As a result, *Edward users today need only small inventories of replacement parts.* The new Edward INTEX valves are a case in point. Only a few simple tools are required for maintenance, and parts are unusually accessible and highly interchangeable. Inexperienced men and women can maintain and operate Edward valves.

Equally important, elimination of "specials" makes possible quantity manufacturing and speeds deliveries. Stick with the standard and you'll get your valves much quicker.

Certain valve types and pressure groupings have been discontinued to free additional war production capacity, but *Edward still builds a complete line of steel valves for all land and marine service temperature and pressure conditions.* Edward sales representatives are experienced valve engineers. Edward valves are also available through leading industrial distributors the country over, with the full assistance of factory engineering and sales staffs at their disposal.

War Materials and War Workmanship

The materials going into Edward valves today are just as good or better than before the war. Actually, very few material substitutions have been required.

Edward workmanship standards, too, are unchanged. Naturally, with a greatly expanded personnel new supervisors have been created, but virtually every new department head or foreman has been promoted from the ranks where he has had imbued in him the Edward principles of closely controlled workmanship. The addition of much new precision equipment makes adherence to Edward standards even more certain.

Post-War Plans

In the Edward laboratories and design departments, an uninterrupted development program is carried on, pointing the way to new refinements, new products, and new post-war applications.

Since our plant is occupied entirely with the manufacture of standard Edward steel valves there need be no time out after the war for reconversion to peace-time valve production. Further, the Company is a closely integrated organization—a single unit complete in one location—making it relatively easy to change to meet changing conditions, yet making possible rigid quality control.

* * *

The only thing certain about the future is that it will be full of change. Undoubtedly many of your problems and ours will be mutual ones. And whether we are able to meet your valve needs or not, we'll be happy indeed to work with you on any matters concerning the procurement, use, maintenance or development of cast and forged steel valves.

W. F. Crawford
President

The Edward Valve & Mfg. Co., Inc.

Cast and Forged Steel Valves — East Chicago Indiana

ARGUMENT CORNER

Replying to "What Can I Do?"

SEVERAL YEARS AGO I was confronted by the same problem, and (to confide in the editor of Argument Corner), I still wonder myself, "What can I do?".

Our friend is a blacksmith who has climbed up to a building superintendent or chief engineer. He wants to get into the high-pressure field, but because he lacks the necessary qualifications he cannot sit for an engineer's examination for h-p stuff.

What is an "engineer" anyway? Recently I filled out my occupational questionnaire, and received a call to appear at the U. S. Employment Office. Arriving there, I was asked, "What are you?" I replied, "An engineer". The office cat, who was doing the questioning, replied, "NO YOU'RE NOT." My little ring around the three years college didn't mean anything. "You have to have four years", he said as emphatically. I showed this gink all the licenses, boiler inspectors' tickets, and commissions, and all he saw was "marine engineer". I was classified "marine engineer" with a code number, and "boiler inspector" with another code number.

We operating-engineers have been registered, licensed, stamped for everything but an "engineer." The real honest-to-goodness engineer is asleep, letting some other "ham an' egger" walk over him.

Look at the ballyhoo of the professional engineers. They gummed up the law books so nobody dared sign or advertise himself as an engineer. The latest racket is a "safety engineers' course", instituted at many colleges. Wherein'ell can a "safety engineer" go with his college diploma when he cannot inspect or even hold a boiler inspectors' commission.

Yet a diploma will take you home! My advice in closing is GET DIPLOMAS, hang them on you as if you were a sandwich man. Parade down the streets and the thoroughfares. Let all the people in the land see you have diplomas. It's the armor of the post-war period that is coming fast.

Grand Rapids, Mich.

JOHN M GORRIE

ALTHOUGH I REALIZE the conditions under which the writer of "What can I do" is trying to better himself I do not understand why anyone in times like the present should have difficulty finding a better position.

A salary of $45.00 per week is very poor compensation for a chief engineer even if he is working for a charitable institution. There are many arguments for and against an engineer's license law and although I favor license legislation and had many battles with the opposition, many times good mechanics cannot get a license only because they do not happen to be in the State a prescribed length of time or through some other technicality of the law.

If the writer of "What can I do" is dissatisfied with his present position why doesn't he try the shipyards? An engineer should be able to get a job as journeyman machinist, pipefitter or electrician at a minimum wage of $1.20 per hour. Many of these journeymen make from $250 to $500.00 per month. The navy needs ships and more ships to fight the war away from our shores and if we cannot deliver them on time there will not be any maintenance jobs for engineers, nor security nor freedom of choosing a life-long job for the future.

San Francisco, Calif.

JOHN H HERZOG

Argument Comments

BRUNO F KOCH'S COMMENT on arguments in December POWER reminds me of a time years ago when, at his request, I tried to explain *pi* to a workman studying arithmetic. I took his book, and for thirty minutes diligently went over the text with him. After using two or three sheets of paper trying to make him understand the meaning of pi, he quit me cold. "It's no use; I can't get it," he said. "It still looks to me like all multiplyin' by that figger does is knock the corners off."

Word for word, that man's remark has stuck with me. That was the first book of arithmetic he had ever looked into. Yet he had a better explanation for pi than I had—or the textbook either, for that matter.

Which brings me to the subject matter of POWER. I don't care how well I *think* I know a subject under discussion. If any man can show it to me in a vivid new light, as that unlearned workman did pi, I'll always be glad to read what he writes or listen to what he says, and count myself wiser when he is through.

Articles based on textbooks doubtless have their place in POWER. But there should be one condition: Each one should have the technical corners knocked off by multiplying by the "pi" of human experience.

Menard, Illinois GEORGE HOLMAN

Changing your address soon? • • •

You will help us give you the good service that is your due by notifying us at once of your change of address. Often the monthly issues of POWER go out of print almost immediately after publication, preventing us from supplying issues that may have been misdirected. Prompt notification of address changes that have been made or will be made prevent your missing a single one of the big valuable monthly issues of POWER.

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NO. 2 OF A SERIES

HOW TUBE-TURN WELDING FITTINGS BENEFIT WAR INDUSTRY

The FIRST WELDING FITTINGS 1ST AND STILL THE BEST

Two ways that Tube-Turn welding fittings avoid wasting men and hours in war plants!

SPEED-UP PIPING INSTALLATION

2 GREATLY REDUCE MAINTENANCE

Faster installed, trouble-free piping steps-up production schedules!

TUBE-TURN fittings speed up piping installation four ways: (1) Need only butt-welds, easy for veteran or novice welders. (2) ess lining-up, for fittings have *uniform* alls and true circularity. (3) Sections pre-sembled on the ground save time. (4) orch cutting and fabricating are elimin-ted. Tube-Turn fittings are ready to weld—pes, sizes and weights for all needs.

You can depend on piping welded with Tube-Turn fittings to be practically maintenance-free, as Tube-Turn welding fittings give the *greatest possible strength* and *long life*. They're *permanently leakproof*. There are no bolts to loosen, no gaskets to replace, no threads to corrode and weaken.

No plant *ever* can afford a break-down or production slow-up, but in war-time it's a disaster! The best insurance in the world against trouble in piping systems is *welding* with *Tube-Turn fittings!*

TUBE TURNS, (Inc.) Louisville, Ky. ● *Branch Offices*: New York, Chicago, Philadelphia, Pittsburgh, Cleveland, Dayton, Washington, D. C., Tulsa, Houston, Los Angeles. ● *Distributors in principal cities.*

TUBE-TURN *Welding Fittings*

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OTHER WAR-TIME ADVANTAGES:

SAVES CRITICAL MATERIAL: Absence of many flanges, bolts, nuts and heavy cast steel construction saves many tons of metal in a single piping system.

FASTER AND EASIER TO INSULATE: Tube-Turn fittings are insulated as easily as the pipe itself, for the welds form one continuous tube.

SAVE SPACE: Pipe systems welded with Tube-Turn fittings permit streamlined, compact layouts and sharp angles.

LAST LONGER: Smooth inner walls—with no ridges, waves or scale—means less corrosion and longer life.

LESS PRESSURE LOSS: Because of full effective radius and exact O.D. and I.D. alignment with the pipe, the flow is more efficient and pressure loss is less.

FEWER SUPPORTS NEEDED: Since welded piping weighs less and stands vibration better than flanged systems, few hangers or supports are required.

POWER LINES

Notice to Subscribers

Readers of POWER will observe that the "trim size" of the current issue of the magazine is slightly smaller than that of previous numbers. The reduction in size has been made to enable the publishers to meet an order of the War Production Board limiting the amount of paper that may be used in 1943. Subscribers will note, however, that no change has been made in size of type or in the amount of editorial content per page, but that a substantial saving in paper has been effected merely by trimming the margins.

The publishers have adopted the new size as a war measure and as a contribution to the conservation of manpower and transportation facilities in the production and distibution of paper. Service to the reader has not been sacrificed and will be maintained as far as humanly possible in the face of the problems confronting all of us in our united efforts to win the war.

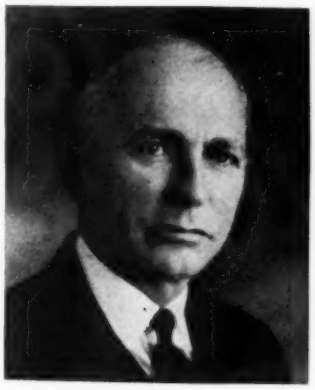
PERSONALS

O W TRUMBULL, formerly of Asbestos Textile Co, is now connected with Greene, Tweed & Co, New York, and has been appointed vice-president and general manager of that corporation.

L W HUTCHINS, president of Sheldon, Morse, Hutchins & Easton, Inc, and director of Safety Research Institute, Inc, of New York, has been appointed chief of the newly organized Education Unit in the Fire Defense Section of the U S Office of Civilian Defense. As director of Safety Research Institute, which is active in fire protection education, Mr Hutchins has been closely associated with the fire safety field for a number of years.

W C CARTER, for 14 years vice-president and for the past year executive vice-president of the Link-Belt Co, Chicago, Ill., has been elected president. He succeeds Alfred Kauffman, who resigned because of ill health. Mr Carter, a mechanical engineering graduate of the University of Illinois, joined the Link-Belt Pershing Road Chicago plant organization in 1902 as draftsman. He has consecutively held the positions of engineering department supervisor, construction superintendent, plant superintendent, plant general manager, vice-president in charge of production. He has been executive vice-president in complete charge of company affairs since Mr Kauffman's illness.

ALEX D BAILEY, chief operating engineer of Commonwealth Edison Co, was advanced to the position of assistant to the vice-president in charge of operating and engineering. He will assist vice-president H B Gear in the administration of the departments under his direction, and will have general supervision over Powerton generating station and its related transmission system.



Alex Bailey

RODERICK D DONALDSON, formerly vice-president of the Utility Management Corp, and officer of numerous operating utilities, has become associated with Gibbs & Hill, Inc, consulting engineers. He will head a department to render advisory and supervisory services to operating utilities.

ROBERT H BISHOP, formerly eastern sales manager of the lighting division of Sylvania Electric Products, Inc, has been appointed to the post of general sales manager of this division. Mr Bishop takes over from CHARLES G PYLE, who recently resigned to accept an appointment as managing-director of the National Electrical Wholesalers Association.

ROGER W ALLEN, district sales engineer for Foxboro Co, Atlanta, Ga., for

(*Continued on page* 174)

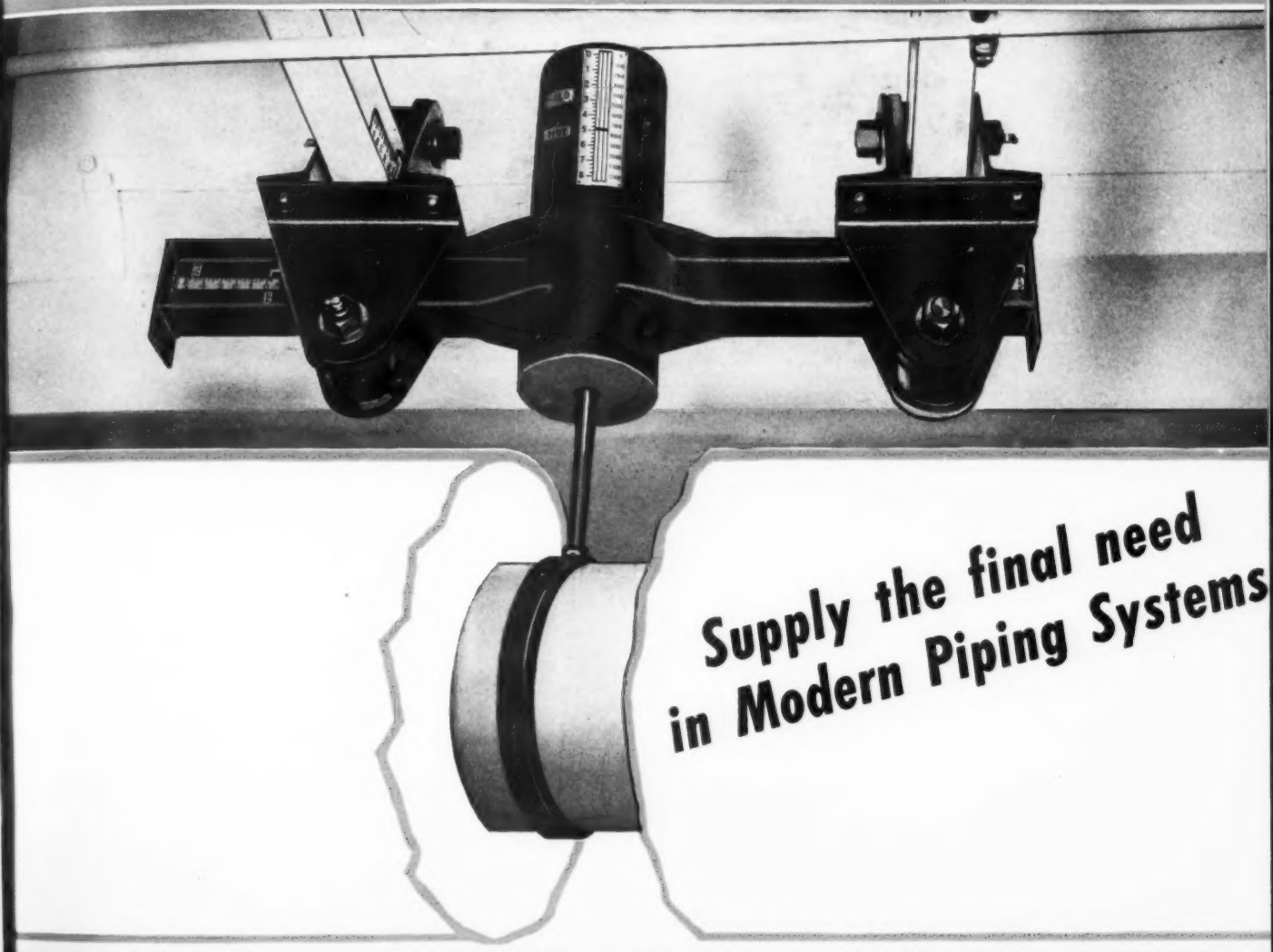
Tips on Oil-to-Coal Conversion

In October, 1942, POWER published an 8-page editorial survey of selected plants that had converted from oil to coal to meet the then expected shortage in liquid fuels. It described a variety of makeshift and permanent arrangements for conversion under wartime restrictions.

This information has practical application in the present East Coast fuel crisis. A few reprints are available and will be furnished free on request (one copy per person) while the supply lasts.

Although unable to be present at the presentation ceremonies, Dr Fieldner, U. S. Bureau of Mines, recipient of the Melchett Medal presented annually by the Institute of Fuel, London, England delivered his acceptance address—by a talking motion picture. Members of the Institute saw the picture at a meeting in the latter part of 1942. The photograph shows the medal being presented by W M Selvey, president of the Institute of Fuel, to Mulford Colebrook, Second Secretary of the United States Embassy in London, (left) who accepted it on behalf of Dr Fieldner

Power Piping Functional HANGERS



Supply the final need in Modern Piping Systems

For improvement and simplification of modern piping systems we recommend the use of FLEX-ANAL CHARTS and Power Piping Functional Hangers.

FLEX-ANAL CHARTS are contained in a technical book entitled Design of Piping for Flexibility, published by Blaw-Knox Company – Power Piping Division, expressly for the use of piping engineers. These charts aid in figuring stresses in high pressure-high temperature piping by means of graphs and highly simplified formulae. FLEX-ANAL CHARTS provide a means of readily determining the magnitude and direction of movements in Piping Systems.*

Power Piping Functional Hangers and vibration eliminators provide for movements of any magnitude and direction within the piping system and eliminate vibration.**

* A copy of "FLEX-ANAL CHARTS" TO ANY ENGINEER ASKING FOR IT ON HIS BUSINESS LETTERHEAD.

**Send for Bulletin entitled POWER PIPING FUNCTIONAL HANGERS AND VIBRATION ELIMINATORS.

BLAW-KNOX COMPANY
POWER PIPING DIVISION
1525 Pennsylvania Ave., Pittsburgh, Pa.

Prevent Valve Failure

NEGLECT ruins a valve, and stops a steam line, when wear-weakened threads are stripped

This spindle was removed from an Iron Body Globe Valve that failed in service on an important steam line. Compare the threads with those on the new spindle, and note the destructive wear due to the grinding action of dirt deposits.

Corresponding wear weakened the threads in the yoke nut to a point where they were stripped when the valve was being closed. The valve blew open, and control of the steam line was lost.

This failure might have resulted in injury, loss of life, or property damage, in addition to the serious slow down in production. It is another example of careless neglect, of faulty measures of valve conservation. Proper maintenance – protection from dirt deposit, periodic cleaning, lubrication, – would have checked the wear. Frequent inspection by trained workmen would, at least, have revealed the unsafe condition of the thread.

For many plants today, valve repair parts are simply unobtainable. And in war production plants, whose priority allows their purchase, such needless valve failure is inexcusable waste of critical metals. Most serious is the lost production, which may hold up the delivery of urgently needed war materiel.

Inspect valves frequently, systematically. Repair or replace worn parts in time to prevent valves from destroying themselves. See that new valves are carefully selected, installed by experts. And train new men thoroughly in care and maintenance.

Jenkins Engineers will assist any management in preparing an effective program of valve conservation upon receipt of details of present valve problems.

Army-Navy "E" Pennant awarded to Jenkins Bros. for high achievement in in the production of war equipment.

Jenkins Bros., 80 White Street, New York, N. Y.; Bridgeport; Atlanta; Boston; Philadelphia; Chicago. Jenkins Bros., Limited, Montreal; London.

JENKINS VALVES

before it starts!

PROPER CARE CHECKS DESTRUCTIVE WEAR...

This illustration shows the accumulation of dust and dirt on an unprotected spindle. It is typical of any installation exposed to coal or ash dust, sand, dirt, grit, soot, cement or any other abrasive material, yet this valve *can* be kept in efficient service indefinitely. The threads should be cleaned, deposits blown off with an air jet, or brushed off, periodically, before they are fed into the nut to start abrasive wear. Lubrication should be as frequent as necessary to permit easy operation, and assist tight closures with little effort.

Where dust conditions are especially bad, improvised protective tubing, booting or telescoping sleeves should be used. Three easy-to-make protectors are illustrated below.

(A) The spindle of this Iron Body Gate Valve is protected by a length of metal tubing, with cap and flange, attached to the spokes of the hand wheel with wire. It prevents the deposit of destructive dust, and also serves as a retainer for grease to insure continuous lubrication. The spindle beneath the wheel is covered by a piece of curved sheet metal.

(B) On this Iron Body Globe Valve, two telescoping tin cans are utilized to shield the spindle, which is normally exposed when the valve is open. The smaller can is fitted up against the wheel, and the larger can below against the yoke bushing lock nut. An expansion spring is inserted inside the cans to hold them apart as the valve is opened.

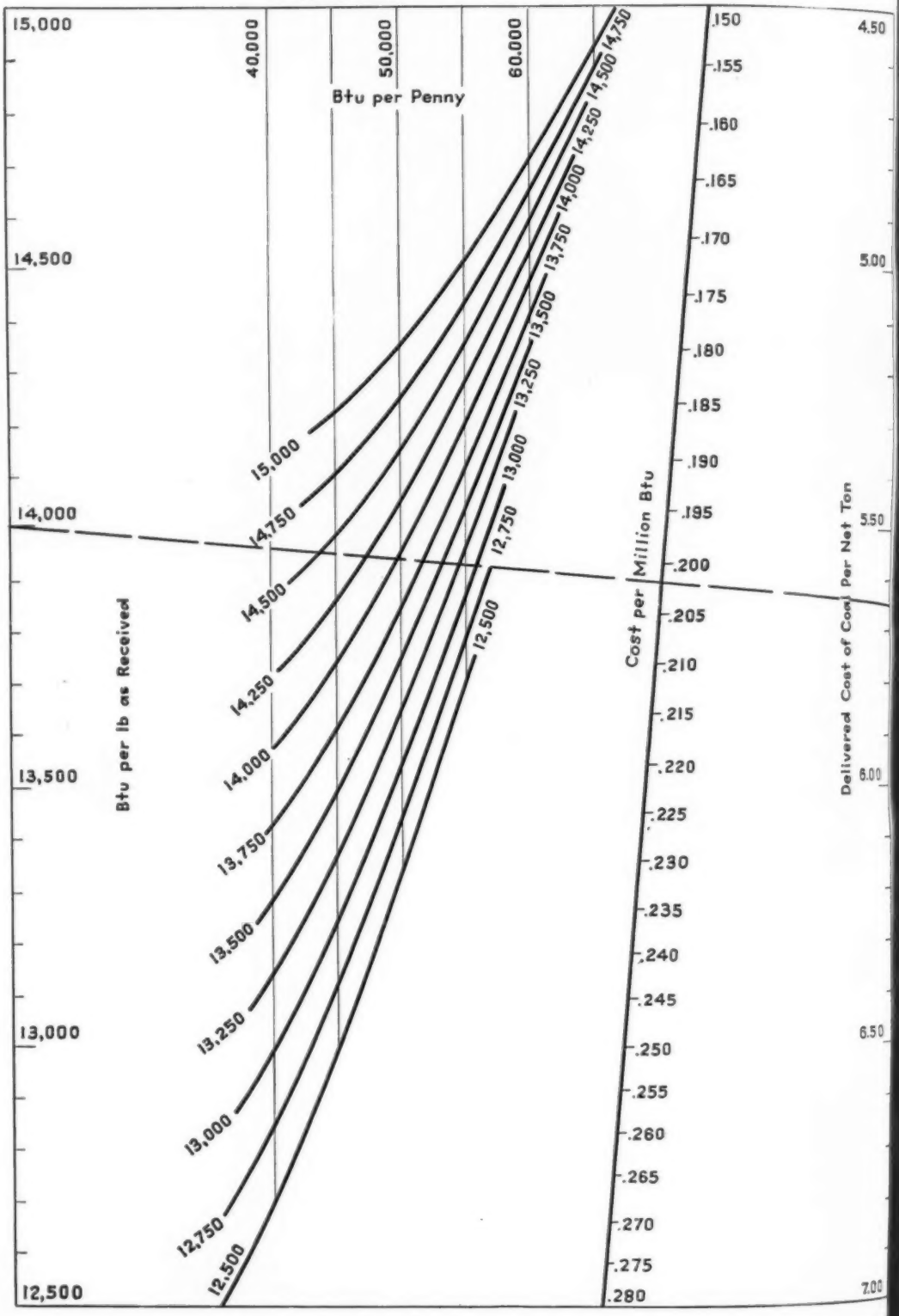
(C) Protection for the spindle of this Bronze Gate Valve is provided by a length of metal tubing for the top, arranged as described in (A), and a leather jacket which is fitted over the bonnet of the valve just below the handwheel. Grease liberally applied inside the leather boot provides lubrication for spindle threads, makes operation easier.

For every industrial, engineering, marine and power plant service

BRONZE ★ IRON ★ STEEL

Number 126

Coal Cost Check Chart



▶ To DETERMINE THE COST per million Btu of coal, draw a straight line from the left-hand scale of Btu per lb as received to the right-hand scale for cost per net (2000-lb) ton delivered. Read cost per million Btu directly from the center scale. I number of Btu per penny is desired, read the inter section of the same cross line with the cente curves using the scale at the top of the chart

R J Buchanan, Koppers Coal Di

*July, 1941—1,700,000 B. H. P.
*Dec., 1941—2,000,000 B. H. P.

Ordered for more than

2,800,000 to Dec., 1942

boiler horsepower

No other steam-flow type feed water regulator has ever been accepted so widely, so quickly. You will find installations of the COPES Flowmatic Regulator now in service or on order:

★

In 35 states and one territory, and in 15 other countries on four of the five continents.

★

On B. & W., Badenhausen, Bigelow, Bros, C-E, Edge Moor, Erie City, Foster Wheeler, Freyn, Lasker, Riley, Springfield, Titusville, Union, Vogt, Wickes and ten other makes of boilers.

★

On boilers operating at pressures of from 80 to 1900 pounds gage.

★

On boilers having capacities from 15,000 to 650,000 lbs. per hour.

★

And 40 users have placed 67 repeat orders for COPES Flowmatics—the best known proof of performance.

To be specific . . . in little more than four years, the COPES Flowmatic Regulator has been ordered for 749 boilers with a total steaming capacity of 98,315,476 pounds per hour. And for good reason. The COPES Flowmatic gives remarkably close water level control . . . usually within plus-or-minus one inch . . . regardless of boiler design, pressure or load conditions. Yet the design is so mechanically simple, the construction so rugged, that no more than routine servicing is needed. For complete information on this two-element steam-flow type regulator, write for Bulletin 429.

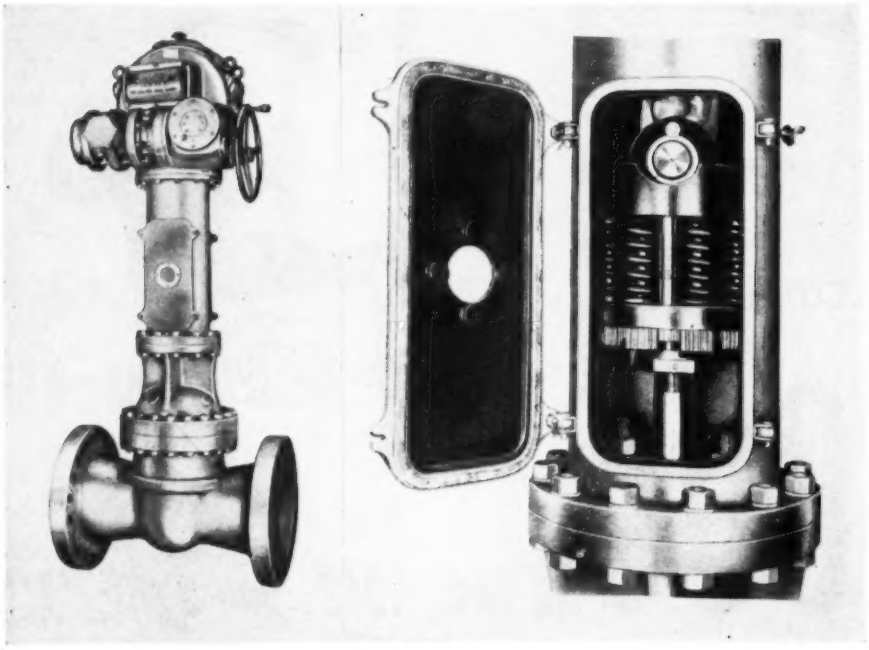
NORTHERN EQUIPMENT CO. 231 GROVE DRIVE, ERIE, PA.

Feed Water Regulators, Pump Governors, Differential Valves
Liquid Level Controls, Reducing Valves and Desuperheaters

BRANCH PLANTS IN CANADA AND ENGLAND REPRESENTATIVES EVERYWHERE

★ GET CLOSER LEVEL CONTROL WITH THE COPES FLOWMATIC ★ REGULATOR

WHAT'S NEW IN PLANT EQUIPMENT



High-Speed Valve Operator

TYPE SC LIMITORQUE VALVE OPERATOR (left) uses a principle of actuation that makes it particularly suited for frequent operation of 3- to 24-in. valves. In this operator, a crank mechanism opens or closes valves up to three times as fast as the conventional operator. A 24-in. valve can be closed or opened under full unbalanced conditions in 3 sec without danger of jamming the valve on its seat or in the open position. Being operated by a crank mechanism, the valve during opening or closing is first accelerated until it is about in mid-position then retarded to open or closed position without shock to the valve, with the crank in position of maximum throw. Crosshead equipped with springs (right) permits seating the valve with a predetermined thrust and assures tight seating regardless of temperature changes. Connecting rod driving the crosshead stops on dead center so that once the valve is closed it cannot back up. Setting for heavy and light seating made simply by adjusting one stud. Control of the operator centers in one switch, a 12-pole drum unit. This switch operates opening and closing limits and indicating lights and provides eight poles to actuate interlocking relays and alarms or to interlock valves. Manual operation is by handwheel that drives through differential gearing so motor always remains engaged, with either manual or electrical operation. Handwheel does not revolve during motor operation and motor is not revolved by manual operation. *Philadelphia Gear Works, G Street below Erie Ave, Philadelphia, Pa.*

Fire Extinguisher

USING DRY ICE, NEW METHOD is available for cooling hot spots and combating spontaneous combustion fires in coal piles. This treatment said to be simple, inexpensive, and effective. Coal pile is first sealed to a height of several feet with wood, building timber, tar or any other satisfactory method of eliminating bottom draft. Three-inch pipe, or any other size suitable, equipped with screw cap on one end and the other end cut and welded to a point, is used to introduce dry ice into the coal pile. A series of $\frac{3}{8}$-in. holes are drilled into the pipe about 6 in. back of the point, and another set of holes drilled about 1 ft above the first set. Pipe should be about 15 ft long, since coal-pile fires rarely occur at depths greater than 10 to 12 ft. Pipes are sunk into the coal pile at any pattern around the hot spot. Dry ice is inserted into each pipe and the cap replaced. Carbon dioxide gas released in the evaporation of the ice makes its way out through the holes in the pipe and smothers any flame effectively. At the same time the refrigerating qualities of the dry ice serve to cool off the "hot spots." Adding fresh dry ice to the pipe when needed will cool the hot spots as required. Where actual combustion exists the same treatment is followed with dry ice introduced into the pipes at regular frequent intervals until the fire is smothered by the accumulation of the carbon dixoide gas given off in the evaporation of the dry ice. *Liquid Carbonic Corp, 3100 S Kedzie Ave, Chicago, Ill.*

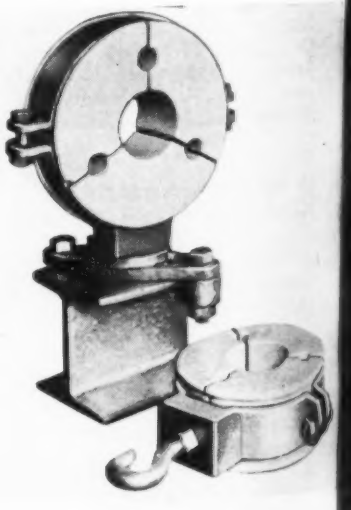
Humidifier

DESIGNED FOR INDUSTRIAL AND INSTITUTIONAL USE on steam-heated systems carrying less than 20-psi steam, new "E-Humidifiers" are quickly installed on the feed-end of radiators or on steam risers at points where condensate will return to the boiler when radiators are turned off. Units are compact and attractive, and entirely automatic in operation; they diffuse exact amount of moisture into the air at the proper time. *Techtmann Industries, Inc, 828 W Broadway, Milwaukee, Wis.*

Cable Support

THREE-CONDUCTOR, steel and porcelain supports occupy minimum space and allow cables to operate at high current density because of close triangular spacing, which results in a balanced circuit with low reactance. Permits multiple circuits of smaller size con-

(*Continued on page* 154)



Will Your "FORTRESS" Be Ready On Time?

Think of the months of training and practice this bomber crew put in before they were ready for the real test.

ALTER EGO: And, think of the *years* of effort engineers and shop men put into the development of the "Flying Fortress" . . . all to enable the crew to rule the airways—to navigate in a bee-line to the destination, fight off "competition" all the way, hit the target and get home safely.

Like the YEARS of preparation that'll be required to develop fortresses of knowledge before business crews can expect to rule the post-war market ways.

ALTER EGO: Right! It'll take shrewd management to steer a course of profits . . . ingenious designing to fight off tough competition . . . efficient production to hit the mark of rock-bottom costs and top quality. All of this *to survive.*

All of which is embodied in the practiced use of arc welding. There's our fortress for survival in the Battle for Business. Let's start developing our welding knowledge NOW by consulting Lincoln.

Ask your inner self if time isn't getting short for post-war planning

THE LINCOLN ELECTRIC COMPANY
CLEVELAND, OHIO

then I said to myself—

WELDED PRODUCTS HIT THE TARGET

OFFICIAL PHOTO U. S. ARMY AIR FORCES

No Room for Rumors

. . . or Murder in the Anteroom

REMEMBER how you schemed to beat the other kids to toting the front end of the town band bass drum? Or how you hauled water for the circus elephants? Or rushed through your own jobs come Saturday to go down and help the fireman polish the "apparatus"?

That was kid stuff, of course, born of the itch to be tied in with celebrities and celebrations. But some kids never grow up; they just lift their sights a little. They wangle invitations to sit on the platform with visiting Senator Bigshot, or to shake the hand of some third-power movie star at a local "premeer".

It's normal to itch to shine, even if in reflected light. Maybe that's why we tell the world's tallest yarns about fishing, fighting and fooling. In peacetime, it's just good clean American fun.

In wartime, it isn't. If your company has just figured out a new gun mount or started a new tank order, that's Uncle Sam's business, not yours. And if you hear, "from a reliable source" as the newspapers say, that such and such is going on—that's Uncle Sam's business too. Every word you spill, even to a friend, may be overheard or passed on. As some smart psychologist said once, "A secret is information shared between *one* people."

There's something else behind such rumors that makes them more dangerous than bombs. The Office of War Information analyzed 4500 rumors current in Washington during the first eleven months of the war. They fell into five general classes:

"Hate" rumors—expressing prejudice, animosity or hostility for groups other than the enemy. In order, the objects of these rumors were: Army administration, business, Catholics, defense workers, draft boards, the English, farmers, Jews, labor, Negroes, profiteers, rationing boards, Red Cross blood-donor service, Russia, and unions.

"Anxiety" rumors—reflecting uneasiness or fear, commonly expressed as unfounded reports of Allied disaster or weakness, or of overwhelming enemy strength. Rumors like these forced premature publication of a carrier sinking several months ago.

"Escape" rumors—indicating wishful thinking about the progress or duration of the war.

"Supernatural" rumors—containing fantastic prophecies of disaster or impending miracles.

"Curiosity" rumors—containing amusing or novel tidbits or supposed "news".

Of these, the "hate" rumors are commonest, most difficult to blot out, hence most probably planted by enemy agents. They do the most harm to all-out war production. The other types grow principally from public tension during wartime, and can be reduced in volume only as we learn to trust our soldiers and our leaders. We've got to remember—and respect—the fact that every American is in a position to know certain things that Hitler would give his eye teeth to find out. Each man's knowledge is usually minor, but a trained spy can put several such reports together and get answers we can't afford to let him have.

To sum it all up, treat unpublished war information as a gentleman does the lowdown on his wife—it's his business, not even his best friend's. Don't repeat a war fact or a rumor—even to deny it. Ask any rumor-monger where he got his information—don't give him or his rumor the benefit of any doubt. Every time you pass on a rumor, or brag about the job you're doing to win the war, you're helping to commit a murder—of a soldier or a sailor who expects you to back him up.

George Edwards

Engineer

MORE EFFECTIVE SEALS FOR PISTONS AND RAMS...

J-M Moulded Packing Cups are made to take the toughest kind of service on all types of slow-moving pistons and rams operating against air, water, steam, oil, etc. Even against extremely high pressures and temperatures they stand up in service and assure a positive seal with minimum friction.

J-M Moulded Cups are "custom-made" . . . moulded to the exact shape and size required. Their composition can be varied to meet specific service conditions. For details on Moulded Packing Cups and on the complete line of J-M Packings, ask for the J-M Packing Catalog. Johns-Manville, 22 East 40th Street, New York, N. Y.

JM

Johns-Manville PACKINGS & GASKETS

THERE'S A DISTRIBUTOR NEAR YOU

WE'VE MADE BILLIONS

—and not one has loosened

THEY'RE on oil well pumps — some for twelve years.

They're standard equipment on rock drills — industry's toughest fastening problem.

They're on tanks, planes, guns—all kinds of wartime material—all kinds of peacetime equipment.

All told, billions of Elastic Stop Nuts have gone to work.

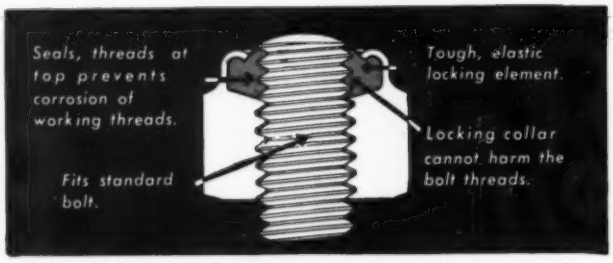
And as far as we know, not one has failed to do its job.

That job is to hold fast and stay put—come what may in the way of vibration, jar or chatter.

Of course the need for such dependable fastenings in war goods and planes is paramount. Some planes take as many as 35,000 in a single ship.

So even at our 4,000,000-a-day rate (which soon will double) the demand keeps growing.

But this constant call for more and more—to meet the exacting responsibilities of war—gives ample proof that Elastic Stop Nuts answer every need for secure locking and speedy fabrication.


Seals, threads at top prevents corrosion of working threads.
Tough, elastic locking element.
Locking collar cannot harm the bolt threads.
Fits standard bolt.

Write for folder explaining the Elastic Stop self-locking principle.

ELASTIC STOP NUT

CORPORATION OF AMERICA

2330 Vauxhall Road, Union, N. J.

WITH THE RED COLLAR — SYMBOL OF SECURITY

Intake Systems

(*Continued from page* 103)

these irregularities by installation of a large plenum chamber. The variation in intake-line pressure and consequently in velocity is shown in Fig. 5, for a single-cylinder engine.

It pays to check pressure drop in the intake piping and particularly in the filters of operating plants. Such checks may show, for example, that poor layout of piping causes excessive pressure drop. Periodic measurement of the pressure drop across filters tells whether filters need cleaning. A simple U-tube arrangement, Fig. 6, proves convenient for the systematic and accurate checking required for good operation.

Experience with the design of many air intakes emphasizes the importance of the following:

1. Don't install air intakes inside the engine room except for small engines or where building heating need not be considered
2. Don't install intake filters too close to the roof of an engine room or excessive vibration roof may result form pulsating air flow
3. Don't install a pump-scavenging or air-injection engine without providing a large plenum chamber in the air intake between filters and engine. Failure to provide a sufficiently large chamber may result in annoying and perhaps serious vibrations.
4. Don't take air from a confined space; serious vibration from air pulsations may ensue.
5. Don't locate air-intake filters in an inaccessible spot
6. Don't make intake-pipe diameter too small and don't make the line too long. Engines can be starved for air, which is just as necessary as fuel.

Readers' Problems

(*Continued from page* 122)

penetrates through the fuel to the grate top; and unless there is sufficient draft leakage to allow enough air to pass through the grates to keep them reasonably cool, the tops will be burned. If there is no leakage whatever, the carrier bars and entire mechanism may be burned.

In the case cited, the fuel bed may be heavier in the center giving an increased source of heat and more resistance to air seepage at that point. Fre-

I'll Live to bury 'em All!

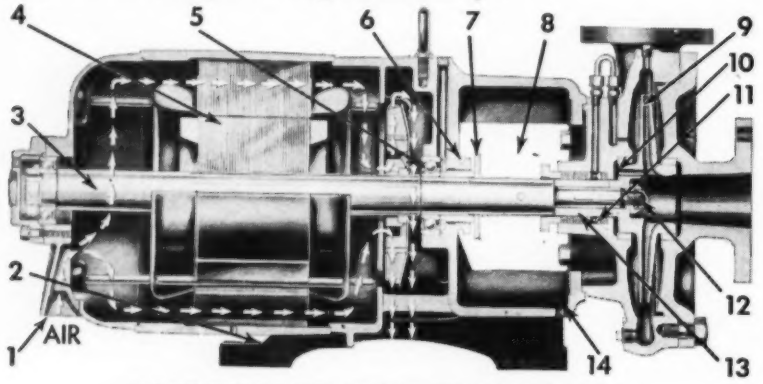
Designed and built to outlive any similar type of small valve, Chapman's forged steel List 960 becomes the "oldest resident" wherever it's installed, on lines from ¼" to 2". And for especially severe duties, this valve may be had with superhardened seats and plugs which impart *even longer life.* So bury all your small-valve troubles for the duration. Standardize on List 960 . . . made in both outside and inside screw models . . . okay for all pressures up to 750 lb. at 800° F., and cold working pressures to 1500 lb. The Chapman Valve Mfg. Co., Indian Orchard, Mass. Branches in key cities.

CHAPMAN LIST 960

The Small Steel Gate Valve that's made extra-tough for Extra Life

Streamlined for APPEARANCE . . . SAFEGUARDED for DEPENDABILITY

Engineered by WORTHINGTON as a *single unit* the MONOBLOC Centrifugal Pump is an outstanding example of compact dependability.



SAFEGUARDS OF PERFORMANCE

1. Correct distribution of ventilating air for motor
2. Extra-high motor support prevents flooding . . . base-plate unnecessary
3. Extra-large diameter one-piece shaft
4. Drip-proof motor with pyramid base
5. Extra-large shielded bearings
6. Solid front head on motor trough . . . no drip enters bearings
7. Correctly designed Neoprene water slinger
8. Greater accessibility for stuffing box inspection
9. Hand finished and balanced impeller
10. Hydraulic balance relieves pressure on stuffing box . . . reduces thrust
11. Extra-deep stuffing box
12. Special construction of impeller lock nut
13. Shaft sleeve extends through stuffing box
14. Extra strength . . . base, motor-end bell and pump bracket, in one piece

WORTHINGTON is the first to build a complete line of truly MONOBLOC *one-unit* pumps for ¼ to 60 horsepower; capacities to 1600 G.P.M; Heads to 500 feet.

SEND FOR BULLETIN W-321-B14

CP3-2

WORTHINGTON
MONOBLOC CENTRIFUGAL PUMPS
WORTHINGTON PUMP AND MACHINERY CORPORATION
General Offices: HARRISON, NEW JERSEY — District Offices and Dealers in All Principal Cities

quently there is air leakage along the sides of the stokers through necessary clearance spaces between the furnace walls and moving parts, and this air leakage may tend to keep the sides relatively cool.

Either or both of these may be responsible for the trouble experienced; the remedies may be:

1. Thinner fuel beds to decrease resistance.
2. More uniform fuel beds.
3. Avoidance as far as possible of sudden and complete draft stoppage.

Barto, Pa. J T WEST, JR

Look For Coal Segregation

CAM DOES NOT STATE how coal is fed to the stokers or if air zoning is used. From the information given it appears to be a case of coal segregation in the stoker hoppers allowing a stream of fines to pass down the center of the stokers. The actual casting damage may be caused by lower ash fusion temperature or variations in the quantity and character of ash in the segregated portion of the coal, or by reduced air flow having less casting-cooling effect.

This theory of coal segregation can be readily checked by taking samples from several sections of stoker hoppers over a representative period and making screen analyses. Ash samples from the affected section may indicate fuel variations by chemical analysis. An optical pyrometer which will indicate spot temperatures is a valuable tool in locating the cause of such troubles as that described by CAM.

The use of alloy castings will prevent failure caused by growth and scaling but will not usually prevent failures caused by high temperatures. As a temporary measure, to keep units operating, introducing steam under the affected section through perforated distributing pipes may be of assistance. The real answer lies in finding the cause of unequal fuel or air distribution and applying permanent remedies.

St John, N. B. C G CLARK

Fine Coal Limits Air Flow Through Grate

I DON'T QUITE UNDERSTAND what CAM means by "mine run screened coal." I am an ex-miner, and to me mine run coal means coal which has not been graded or screened in any way, coal as loaded by miners. Perhaps CAM means

2-CYCLE DOUBLES NUMBER OF POWER STROKES

Every Down Stroke a Power Stroke

The 2-cycle engine was developed to eliminate what was known as the "waste" stroke in 4-cycle operation. In the 2-cycle engine, instead of only half of the piston's down-strokes being power strokes, every down-stroke is a power stroke!

In the perfected CLARK Super-2-Cycle Engine this has resulted in power output also being actually doubled, as compared with the 4-cycle engine of equivalent size and displacement.

In addition to doubled power, the 2-cycle principle as perfected in CLARK "Angle" Compressors, offers these basic advantages:

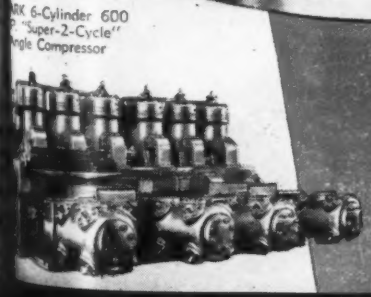
1. GREATER SIMPLICITY — No intake or exhaust valves.
2. GREATER FUEL ECONOMY—due to Clark patented Fuel Injection.
3. LESS WEAR—as the power is produced with half the number of power cylinders.
4. SMOOTHER OPERATION.
5. FEWER MAN HOURS — due to simple design, few parts, and ease of servicing vertical cylinders.
6. LOWER OIL CONSUMPTION.
7. LOWER INSTALLATION COST—due to shipment assembled, small foundations, small buildings.

These points, explaining the leadership of the CLARK "Angle", merit your thorough investigation. Our engineers are at your service.

CLARK BROS. CO., INC. . . . . .OLEAN, NEW YORK, U. S. A.

Export Offices: 30 Rockefeller Plaza, New York. Domestic Sales Offices and Warehouses: Tulsa, Okla.; Houston, Texas; Chicago, Ill. (122 S. Michigan Ave.); Boston, Mass. (131 Clarendon St.); Huntington Park, Calif. (5715 Bicket St.) Foreign Offices: 72 Turnmill St., E. C. 1, London; Avda Roque Saenz Pena 832, Buenos Aires.

Affiliated Companies: Dresser Mfg. Co., Bradford Pa.; Pacific Pump Works, Huntington Park, Calif.; Bryant Heater Co., Cleveland, Ohio.

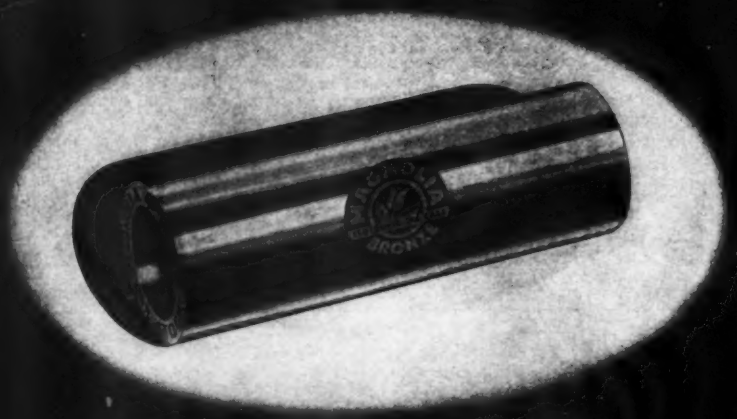


RK 6-Cylinder 600
"Super-2-Cycle"
ngle Compressor

CLARK

Super-2-Cycle

SPECIAL CASTING METHOD MAKES VITAL BRONZE WEAR LONGER



Magnolia Isotropic Bronze is die-cast by our exclusive crystal control method which produces a more homogeneous structure than that of ordinary bronze bearing stock. Magnolia Bronze is stronger and stands much greater strains. It presents a uniform bearing surface which is free of blow holes, cracks or spongy material and wears longer than any sand cast bronze. The die casting process produces bars free of tiny, hard sand particles which might ruin valuable cutting tools and wear shafts like sandpaper.

700 stock sizes...cored or solid bars...fully machined, inside, outside and on the ends...Ultimate Strength, psi, 31,250 • Yield Point, psi, 26,000 • Elongation in 2", 8.5% • Brinell 70.

Write for Bulletin

MICROPHOTOS SHOW THE BIG DIFFERENCE

Left — ordinary sand cast . . . right — Isotropic die-cast . . . both from same heat. Note spongy structure, segregated lead and white Cu-Sn crystals of the sand cast specimen as compared to absence of segregation and complete dentritic crystallization of die-cast bronze.

MAGNOLIA METAL COMPANY • ELIZABETH, N. J.

MAGNOLIA

Isotropic Die-cast

BEARING BRONZE

BY THE MAKERS OF MAGNOLIA ANTI-FRICTION METAL

unwashed screenings frequently fired on chain-grate stokers.

I mention this because I definitely place the source of CAM's trouble in the method he uses to fill his stoker hoppers. The chutes from his bunkers are doubtless in a fixed position, so that the coal pours into the hopper near the center. Or, if the chutes can be moved the operator seldom shifts them from their center position in filling the hoppers.

By filling at the center the larger lumps roll toward the ends of the hoppers. The fines and heavy impurities, such as tramp iron and sulphur bands (iron pyrites), remain directly under the chutes. As the coal passes under the gates, there is a stream of fines and heavy impurities moving down the center, with a stream of lumps to each side. There is little surface contact between the lumps, and between lumps and grate. A plentiful supply of air comes up about the links and keeps them cool.

This condition cannot possibly prevail with the fines near the center. While they offer more surface area for burning, these fines do not let enough air pass for rapid combustion, and not enough to keep the grate links cool. From the time of ignition under the arch until the grate turns downward at the water back the heat creeps closer to the links. This is especially true if there is enough pyrite present to produce fusion of the fines. A single piece of pyrite will start the formation of a clinker mass which will not only exclude air, but will flow downward between the links and fuse with them. Pyrite in contact with iron will lower the melting point of this metal, as will also a bolt or other piece of iron or mild steel already molten.

The solution of CAM's problem is obvious: There must be a uniform mix of coal passing under the grate at all times.

Menard, Ill. GEORGE HOLMAN

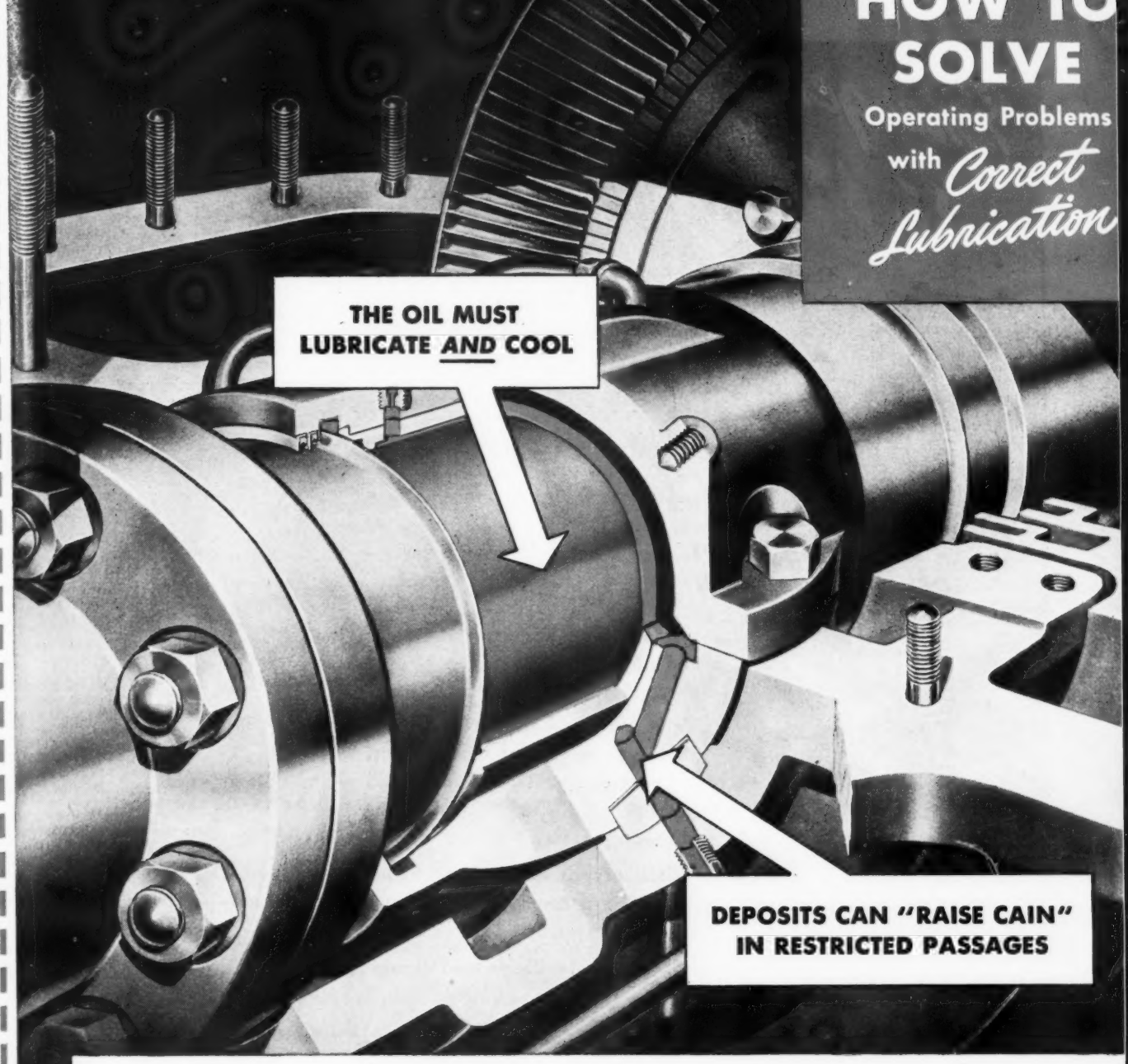
New Power Construction

Construction to Come

Ark., Eldorado—City Airport Comn, Eldorado, plans constructing imprvs, Magnolia Hy, 7 mi west of here. $2,000,000. $1,700,000 CAA allot.

California—Bureau Reclamation, Custom House, Denver, Colo., received no bids Dec 7, furnishing gate valves for installing in station-service penstocks, Shasta Power Plant, Kennett Div, Central Valley Project, Spec 1678-D, Shasta Co.

ONE OF A SERIES OF SUGGESTIONS TO AID PRODUCTION



Use "Character" Analysis!

PROBLEM: Selecting turbine oil is a major decision. For only an oil film stands between safe operation and possible destruction of the turbine. The oil must maintain a high chemical stability over a long period of service, because deposits resulting from oil oxidation may interfere with free oil flow through the bearing and governing apparatus. This will cause higher operating temperatures, rapid oxidation, even disastrous bearing failure.

ANSWER: The most dependable way to foretell what a turbine oil will do is to analyze its character. *What has it done for others over a long period?* Gargoyle D. T. E.'s are used in over 50% of U. S. A.'s major-sized turbines and have service records of over 120,000 hours in a single turbine. It has been *proved* that their chemical stability assures trouble-free lubrication. These oils are far-and-away your wisest and safest choice.

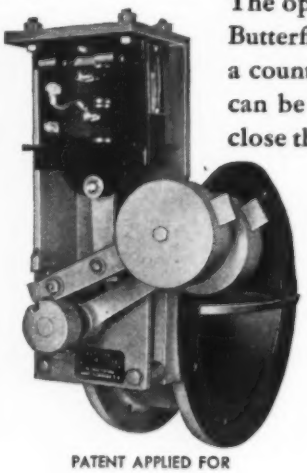
GARGOYLE
Lubricants

SOCONY-VACUUM OIL COMPANY, INC.— Standard Oil of N. Y. Div. • White Star Div. • Lubrite Div. • Chicago Div. White Eagle Div. • Wadhams Div. • Southeastern Div. (Baltimore) • Magnolia Petroleum Co. • General Petroleum Corp.

CALL IN SOCONY-VACUUM

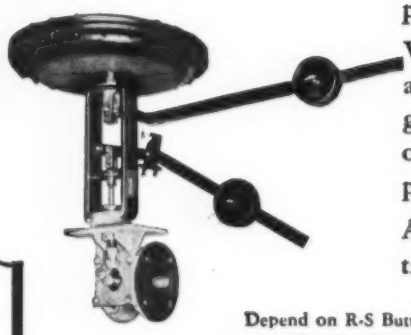
ONE OF A SERIES OF SUGGESTIONS TO AID PRODUCTION

Emergency FIRE FIGHTERS



PATENT APPLIED FOR

The operating solenoid in this assembly of an R-S Butterfly Valve connects to the valve vane through a counter-weighted lever and latch. The solenoid can be arranged with the mechanism to open or close the valve and hold it there in one position or the other. Failure in the current to the solenoid for any reason results in tripping the latch and permits the counter weight to close or open the valve by gravity. The assembly is suited for emergency use to shut-off flow wedge-tight or to open a vent. Used on sprinkler and foam systems, tank discharge, gas lines and for electrically driven blower protection.

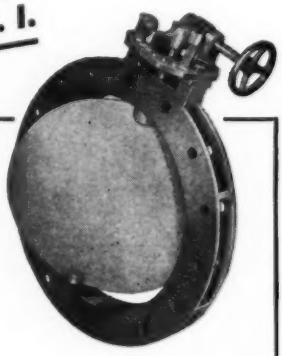


Valve can be constructed of any alloy and in various sizes for air, gases, steam, oil, hydraulic and other services. Resetting is accomplished by hand.

A similar type trip valve can be controlled by pressure as illustrated.

Depend on R-S Butterfly Valves for low-cost, manual or automatic control and wedge-tight shut-off of volume and pressure. Sizes range from 2 to 84 inches.

15 to 900 P. S. I.



Wafer (narrow face to face) valves are suitable for pressures up to fifteen pounds. They are light in weight yet high in regulating efficiency.

Write for Catalog No. 10-B.

BUTTERFLY VALVE DIVISION

R-S PRODUCTS CORPORATION

4536 Germantown Avenue • Philadelphia, Penna.

R-S QUALITY PRODUCTS SINCE 1908

R-S Streamlined BUTTERFLY VALVES

Calif., Fairfield-Suisum—U. S. Eng, 1209 8 St, Sacramento, plans constructing imprvs. Over $2,000,000.

Illinois—Defense Plant Corp, 38 S Dearborn St, Chicago, Ill., plans constructing hemp plants. Commodity Credit Corp, The Mall, between 12 and 14 Sts S W, Wash, D. C will operate.

Ill., Aurora—Civil Aeronautics Admin, 14 St, between E St, and Constitution Ave N W, Wash. D. C., plans constructing imprvs $1,200,000. Referendum will be held Feb 22 issuance of bonds for purchase of site.

Indiana—Commodity Credit Corp. The Mall, between 12 and 14 Sts S W, Wash, D. C., plans constructing hemp processing plants. $1,500,000.

Kansas—U. S. Eng, 601 Davidson Bldg, Kansas City, Mo., plants constructing imprvs $3,000,000.

Kansas—U. S. Eng, 601 Davidson Bldg, Kansas City, Mo., bids soon constructing imprvs, Ford Co $1,000,000.

Kansas—U. S. Eng, Albuquerque, N. M., plans constructing imprvs, Seward Co $3,000,000.

Kansas—Defense Plant Corp, 811 Vermont Ave N W, Wash, D. C., plans constructing addnl plant facilities. Over $2,300,000. Boeing Aircraft Co, Seattle, Wash., will operate.

Ky., Sturgis—U. S. Eng, Federal Bldg, Louisville, plans constructing imprvs. Over $2,000,000.

Michigan — Aluminum Company of America, Dunn Rd, Detroit, plans converting plant and addn. $3,000,000. Defense Plant Corp will finance.

Minn., Minneapolis—City, Bd Park Comrs, plans to sell $3,000,000 bonds, constructing imprvs north of city. Total est $7,000,000-$8,000,000.

Minn., South St Paul—Farmers Union Central Exchange, E A Syfestad, mgr, 1200 N Concord St, plans constructing oil refinery. $1,000,000.

Missouri — Civil Aeronautics Admin, City Hall, Kansas City, Mo., plans constructing imprvs, Boone Co. Under $1,000,000.

Missouri—U. S. Eng, 601 Davidson Bldg, Kansas City, Mo., plans constructing imprvs. $3,000,000.

Nebraska—U. S. Eng, 1709 Jackson St, Omaha, plans constructing imprvs Knox Co. Over $1,000,000.

New Jersey—General Motors Corp, General Motors Bldg, Detroit, Mich., plans constructing addnl plant facilities, over $200,000; addnl plant facilities. Over $2,000,000. Defense Plant Corp will finance.

New Jersey—U. S. Eng, 6 and Walnut Sts, Phila, Pa., plans constructing imprvs, addnl work, Burlington Co. $1,000,000.

New York—Republic Aviation Corp, Farmingdale, plans constructing addnl plant facilities. Over $5,000,000. Defense Plant Corp will finance.

Ohio—Defense Plant Corp, 811 Vermont Ave N W, Wash, D. C., plans constructing plant. Over $3,000,000. Sun Oil Co, 1608 Walnut St, Phila., Pa. will operate.

Ohio—Fisher Body Div General Motors Corp, 121 General Motors Bldg, Detroit, Mich., receiving bid constructing superstructure for plant. Federally financed.

Pennsylvania — Industrial Company plans, by United Engineers & Constructors, Inc, engrs and archts, 1401 Arch St, Phila. rehabilitating mfg bldgs; reclaiming from wrecking bldgs at site mfg bldgs; power house, office bldg, concrete water reservoir. $500,000-$1,000,000.

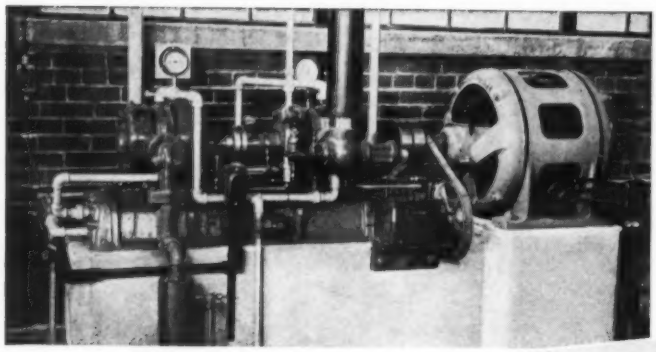
We too are behind the NATIONAL 8-BALL

Wartime troubles is the national 8-ball behind which many a manufacturer finds himself today. Priorities, restrictions, shortages of materials, transportation, and the urgent need for Super-Silvertop Steam Traps have helped to make uncertainties in the filling of orders. We believe it's safe to say that no manufacturer of traps can fill every order and ship when requested. For this reason we ask our customers to be as patient as possible and we'll do all we can to give you as many Super-Silvertops as we can when we can. Remember that we are doing our best under the imposed wartime limitations.

If you are not acquainted with Super-Silvertop Steam Traps, we believe this is an excellent opportunity to send for a copy of the book "How To Choose A Steam Trap" and read it over, looking forward to the day when there will be plenty of Super-Silvertops for all.

THE V. D. ANDERSON COMPANY
1934 West 96th Street • Cleveland, Ohio

Four Years' Operation . . . No Maintenance Expense



February 23, 1942.

The Fuller Company,
Catasauqua,
Penn., U.S.A.

Attn: Mr. E. P. Meixwell

Gentlemen:

In January 1938 we purchased a two-stage Fuller Rotary Compressor Size C-16-16H, and since installation it has run 23 hours per day almost continuously and has given no trouble.

As we are dependent upon an air supply for a number of operations and would be greatly inconvenienced in case of machine failure, we are considering the possible need of machine spare parts which could be used in case of a breakdown.

Are there such parts which experience has shown may need replacement due to wear or breakage, and which should be kept in stock, especially in view of the present and future industrial conditions which might make the replacement more difficult to obtain?

Your recommendations in this connection would be greatly appreciated.

Yours very truly,

YOUR COMPRESSORS spot WHERE YOU NEED THE AIR

Here's a letter that tells a story better than any words we could use. Nor is it an exceptional case . . . hundreds of users of Fullers are reaping the same benefits. It further strengthens the claims we have been making, that you too can profit by installing Fuller Rotary Compressors and Vacuum Pumps.

There's every logical reason for long, continuous service with these units. Simple, sturdy construction; a minimum of moving parts—rotor, bearings, blades.

In these times when shut-downs are costly . . . lost time can never be recovered . . . it's up to you to see that the very best equipment is installed in your plant.

FULLER COMPANY

CATASAUQUA, PENNSYLVANIA

Chicago: 1144 Marquette Bldg. San Francisco: 421 Chancery Bldg.

C-70

FULLER-KINYON, FLUXO, AND AIRVEYOR CONVEYING SYSTEMS · · · · ROTARY FEEDERS AND DISCHARGE GATES
ROTARY AIR COMPRESSORS AND VACUUM PUMPS · · · · AIR-QUENCHING COOLERS · · · BIN SIGNALS

Tennessee—Yards & Docks, 18 St and Constitution Ave N W, Wash, D. C., plans constructing bldgs, facilities, Shelby Co. $2,000,000.

Tenn., Nashville—Thos L Cummins, mayor, plans constructing imprvs. Under $1,000,000.

Texas, Pennsylvania and New York—Reconstruction Finance Corp, 811 Vermont Ave N W, Wash, D. C., preliminary plans constructing 760 mi 20-in welded joint steel pipeline carrier between Houston, Tex., Phila, Pa., and New York, N. Y., areas, 200,000- to 250,000-bbl daily capacity. $90,000,000.

Texas—U. S. Eng, 416 Wright Bldg, Tulsa, Okla., plans constructing imprvs, expansion, installations and facilities, Gray Co. $5,000,000.

Texas—U. S. Eng, 31 W Main St, Denison, receiving bids constructing imprvs, bldgs, Smith Co. Over $3,000,000. Plans deposit $100.

Texas—U. S. Eng, 231 W Main St, Denison, plans constructing imprvs, bldgs, facilities, etc, Gregg Co. $5,000,000.

Texas—U. S. Eng, Fort Sam Houston, receiving bids constructing bldgs, Coryell Co. $3,250,000. Total est $5,500,000. Plans deposit $100.

Texas—Yards & Docks, Navy Dept, 18 St and Constitution Ave N W, Wash, D. C,. bids soon constructing imprvs, grading, site development, bldgs. Total est $9,000,000.

Tex., Corsicana—Texas Power & Light Co, Corsicana, receiving bids extending Trinidad steam electric station, 30 mi east of here. Over $40,000.

Tex., Houston—Nyotex Chemical Co, c/o C F Dunasky, M. Esperson Bldg, Houston, receiving bids constructing lime and chemical manufacturing plant, $6,000,000 complete project.

Tex., Tyler—U. S. Eng, 231 W Main St, Denison, plans constructing imprvs $5,000,000.

Utah—U. S. Eng, 32 Exchange Pl, Salt Lake City, plans constructing bldg addns, Box Elder Co under $2,000,000.

Virginia—Bids after Dec 14, by Pub Housing Auth, NHA, Temporary Bldg 2, 19 and D Sts N W, Wash, D. C., constructing housing, Va. 44018.

Washington — Seattle-Tacoma Shipbuilding Corp, 2400 11 St S W, Seattle, plans constructing imprvs, bldg. $2,000,000. Federally financed.

Wash., Seattle—Bids Jan 21, by City, County-City Bldg, constructing second step Ross Dam (concrete arch type) across Skagit River, Whatcom Co $10,000,000. FWA Plans deposit $25. E R Hoffman, City Light Bldg, city light supt.

Contracts Let

Alabama—Yards & Docks, Navy Dept, 18 St and Constitution Ave N W, Wash, D. C., awarded contract constructing imprvs, exten, NOY 5269, general construction, to Doullut & Ewin, 710 Interstate Bank Bldg, New Orleans, La.*** structural steel, to Ingalls Iron Works Co, 720 4 Ave S, Birmingham, Ala.*** electrical work, to D T Odom Electric Co, 629 Julia St, and E Phillips, 117 Decatur St, both New Orleans, La.***piping to A M Lockett & Co, Ltd, Whitney Bldg, New Orleans. Est $6,000,000.

Alabama—U. S. Eng, Fort McClellan, awarded contract constructing bldgs, Calhoun Co, to Dethlefs-Boozer Constr Co, Anniston, $500,000-$1,000,000.

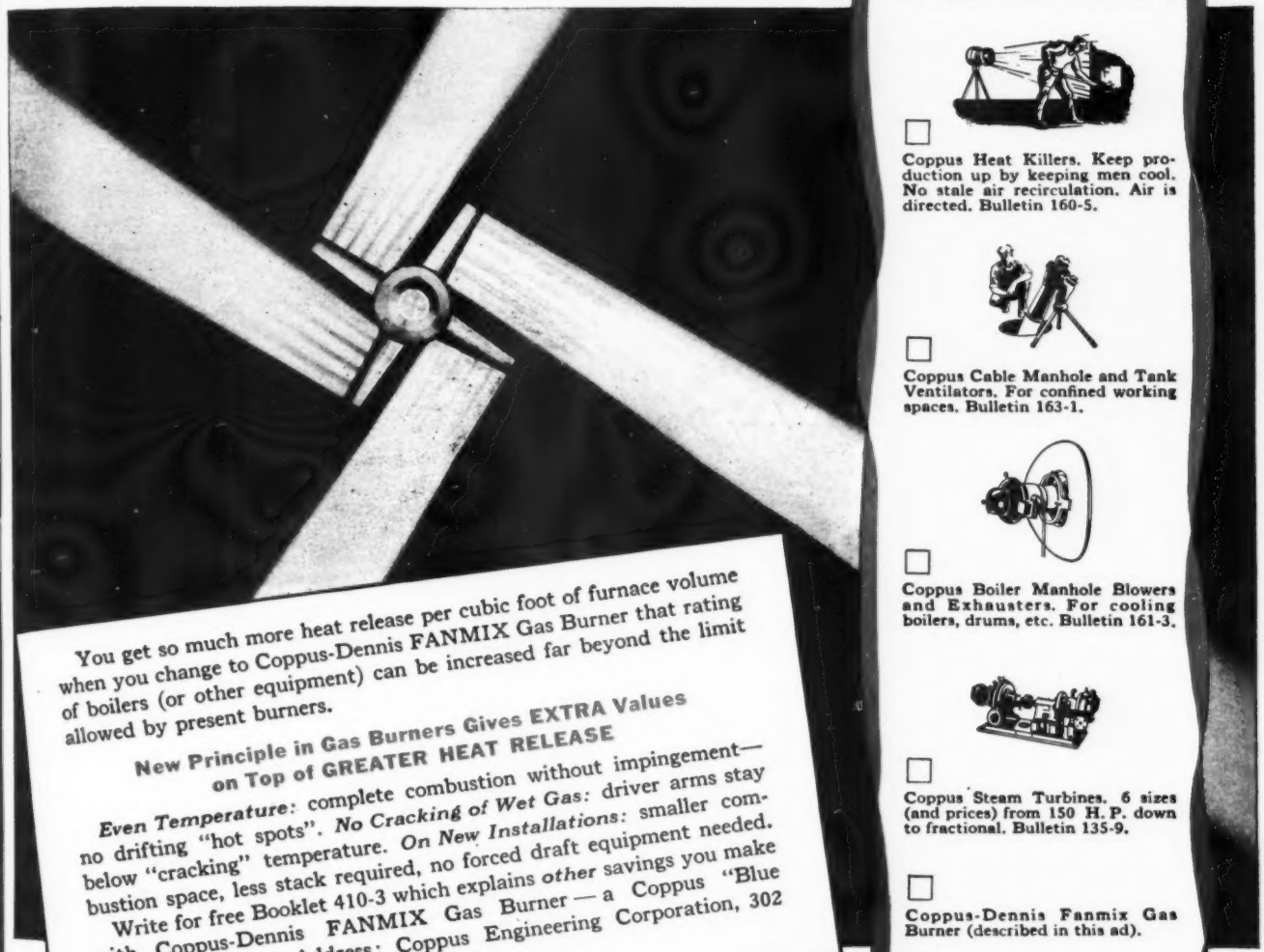
California—U. S. Eng, 751 S. Figueroa St, Los Angeles, awarded contract con-

HOW TO INCREASE THRU-PUT BY ONE SIMPLE CHANGE

Pinwheel Action STEPS UP RATINGS

Installing Coppus-Dennis FANMIX Gas Burners permits increased heat release per cubic foot of furnace volume

"Pinwheel Action" combines gas with air in a properly proportioned mixture. Gas escaping from orifices in the blades, rotates the fan, causing in-take of air at right angles to path of gas. The energy in gas under pressure is utilized to perform work by mechanically mixing and proportioning the gas with just the proper amount of air, thus eliminating from the furnace the necessity of serving as a mixing chamber as well as combustion space.



You get so much more heat release per cubic foot of furnace volume when you change to Coppus-Dennis FANMIX Gas Burner that rating of boilers (or other equipment) can be increased far beyond the limit allowed by present burners.

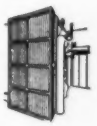
New Principle in Gas Burners Gives EXTRA Values on Top of GREATER HEAT RELEASE

Even Temperature: complete combustion without impingement—no drifting "hot spots". *No Cracking of Wet Gas:* driver arms stay below "cracking" temperature. *On New Installations:* smaller combustion space, less stack required, no forced draft equipment needed.

Write for free Booklet 410-3 which explains *other* savings you make with Coppus-Dennis FANMIX Gas Burner — a Coppus "Blue Ribbon" Product. Address: Coppus Engineering Corporation, 302 Park Avenue, Worcester, Massachusetts.

You'll get valuable ideas from these free bulletins on other Coppus Blue Ribbon Products

(*Check the ones you want*)



☐ Coppus Unit Air Filters. For industrial ventilating and air conditioning systems. Bulletin F-320-5.

☐ Coppus Heat Killers. Keep production up by keeping men cool. No stale air recirculation. Air is directed. Bulletin 160-5.

☐ Coppus Cable Manhole and Tank Ventilators. For confined working spaces. Bulletin 163-1.

☐ Coppus Boiler Manhole Blowers and Exhausters. For cooling boilers, drums, etc. Bulletin 161-3.

☐ Coppus Steam Turbines. 6 sizes (and prices) from 150 H. P. down to fractional. Bulletin 135-9.

☐ Coppus-Dennis Fanmix Gas Burner (described in this ad).

Name.....

Company.....

Address.....

City.....State.....

COPPUS

Sales Offices in THOMAS' REGISTER. Other "Blue Ribbon" Products in SWEET'S CATALOG.

COPPUS BLUE RIBBON PRODUCTS DESIGNED FOR YOUR INDUSTRY . . . ENGINEERED FOR YOU

One glance inside the case of a Frahm Tachometer shows its striking simplicity. The sole mechanism is a set of accurately tuned steel reeds which pick up the minute vibratory impulses of the machine which the instrument need merely touch, and the R.P.M. is indicated on the scale by a sympathetically vibrating reed. Because *no contact with the rotating element is required,* these instruments solve troublesome problems of indicating speed . . . without belts, gears, flexible shafts or electrical connections.

This principle and the method of indication are unique among speed measuring instruments. The Frahm Resonant-Reed Tachometer is as accurate as it is simple, with no parts to wear, adjust, lubricate or renew. It can be used in any position and will give years of trouble-free service. Built in types for permanent mounting . . . and for hand use in servicing, installation and maintenance work. Various ranges available from 900 to 30,000 R.P.M.

For a complete description of Frahm Tachometers together with lists of types and ranges commonly supplied, write for Bulletin 1590P.

JAMES G. BIDDLE CO. • 1211-13 ARCH STREET PHILADELPHIA, PENNA.

structing bldg, No. 981, San Bernardino Co, to Jas I Barnes Constr Co, 1115 Montana Ave, Santa Monica under $1,000,000.

California—U. S. Eng, 74 New Montgomery St, San Francisco, awarded contract constructing cold storage warehouse, Monterey Co, to H C Geyer, 787 Munras Ave, Monterey.

California—Yards & Docks, Navy Dept, 18 St and Constitution Ave N W, Wash, D. C., awarded contract constructing Supplemental Agreement 3, imprvs, NOY 4279, to Guy F Atkinson Co, 662 Russ Bldg, San Francisco, and George Pollock, Box 903, Sacramento, $14,131,008.

Calif., San Diego—Yards & Docks, Navy Dept, 18 St and Constitution Ave, N W, Wash, D. C., awarded contract constructing west coast sound school NOY 5880, to Stanton-Reed Co and J W Breedlove Corp, 816 W 5 St, Los Angeles, $1,259,000.

Del., Dover—U. S. Eng, 6 and Walnut Sts, Phila, Pa., awarded contract constructing imprvs, paving, etc, to George & Lynch, Delaware Trust Bldg, Wilmington, to exceed $1,000,000.

Ill., Chicago—Commonwealth Edison Co, 72 W Adams St, awarded contract constructing remodeling electric power station, 3200 A 100 St, to Herlihy Mid-Continent Co, 140 S Dearborn St, $75,000, Sargent & Lundy, 140 S Dearborn St, engrs.

Kentucky—Defense Plant Corp, 811 Vermont Ave N W, Wash, D. C., awarded contract constructing plant, to Engineering Staff of B F Goodrich Co, 500 S Main St, Akron, Ohio, construction, to Batson & Cook, West Point, Ga., Prack & Prack, Martin Bldg, and Chester Engineers, 210 E Park Way, both Pittsburgh, Pa., engrs Blaw Knox Co, Farmers Blvd, Pittsburgh, Pa., process engr. Est $4,000,000, National Synthetic Rubber Corp (Goodall Rubber, Inc, Hamilton Rubber Mfg Co, Hewitt Rubber Corp, Lee Rubber & Tire Corp and Minnesota Mining & Manufacturing Co), will operate.

Kentucky—U. S. Eng, Federal Bldg, Louisville, awarded contract constructing storage reservoir, Hardin Co, to George Kehl & Son, 1225 N Maplewood Ave, Chicago, Ill., under $1,000,000.

Louisiana—U. S. Eng, 5 St and Avenue F, Galveston, Tex., awarded contract constructing bldg, Calcasieu Parish, to Port City Constr Co, P O Box 22, Lake Charles, under $1,000,000.

Louisiana—U. S. Eng, foot Prytania St, New Orleans, awarded contract constructing bldg, to Tudor & Ratcliffe, Alexandria, under $1,000,000.

Louisiana—Yards & Docks, Navy Dpt, 18 St and Constitution Ave N W, Wash, D. C, awarded contract constructing bldg, to J A O'Brien, 816 Howard Ave, New Orleans, under $1,000,000.

Michigan—U. S. Eng, 700 Union Guardian Bldg, Detroit, awarded contract constructing control tower and control tower switch room, Macomb Co, to Campbell Constr Co, 3255 Goldner St, Detroit, less than $1,000,000.

Michigan—U. S. Eng, 700 Union Guardian Bldg, Detroit, awarded contract constructing bldg, Wayne Co, to J A Utley, 723 E Ten Mile Rd, Royal Oak, Detroit, less than $1,000,000.

Michigan—U. S. Eng, 700 Union Guardian Bldg, Detroit, Mich., awarded contract constructing imprvs, Chippewa Co, to Spencer, White & Prentis Inc, 10 E 40 St, New York, N. Y. Est. $1,000,000.

Mississippi—U. S. Eng, U. S. Courthouse & Customhouse, Mobile, Ala., awarded contract constructing bldgs, Clarke Co, to B L Knost, Meridian under $1,000,000.

WHY SOME TURBINE OILS NEED CHANGING AND TREATING AND NONPAREIL DOES NOT

● Just how long a conventional turbine oil will last is anybody's guess. But each of them, sooner or later, should be changed or removed from the oil system for treating to reduce acidity, or for removing sludge deposits or water.

But not so with Nonpareil. Records of Nonpareil still in service after 10 to 15 years show that the oil has never been removed for treating, or for cleaning the oil system. Furthermore, Nonpareil is guaranteed not to increase in acidity above the extremely low neutralization number of 0.15.

WHAT HAPPENS TO A TURBINE OIL IN SERVICE?

The conditions under which turbine oils operate—rapid circulation, at fairly high temperatures—tend to increase chemical absorption of oxygen by the unstable hydrocarbons in the oil—that's called oil oxidation. This, in turn, brings on a host of oil troubles, such as high acidity, sludging, excessive increases in viscosity, and poor demulsibility. Any one of these is reason enough for removing the oil before it damages the turbine.

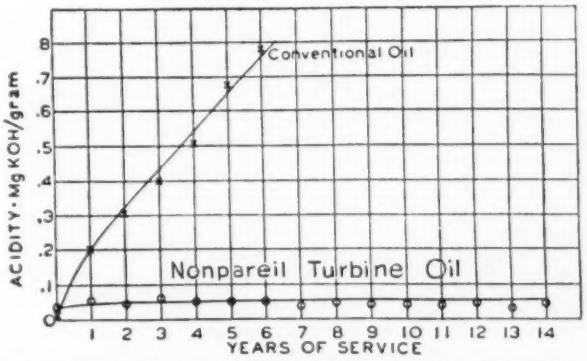
THE REFINER WAS IN THE MIDDLE

An easy solution might seem to be the removal of unstable hydrocarbons by refining. This can be and is done. But very highly refined oils frequently develop acidity faster than some less highly refined oils, because of the removal of natural inhibitors in the oil.

Therefore, until about 15 years ago, a turbine oil was of necessity a compromise product . . . not too highly refined to cause excessive acidity formation, but sufficiently refined to prevent excessive oxidation and sludge formation.

PATENTED INHIBITOR DEVELOPED

Then the *patented* inhibitor used in Nonpareil was developed. The inhibitor, added to a highly refined oil, prevents acidity development. Now, unstable hydrocarbons can be removed, which eliminates the sludge-forming and emulsion-producing tendency of the oil, and the inhibitor is added. Result—a turbine oil that lasts as long as your turbine, without replacement or treating. A small amount of make-up oil (about 10% per year) automatically replenishes the inhibitor. Your turbine oil systems never need cleaning and your fill of Nonpareil is *guaranteed* for the life of your turbine.



Comparison of acidity development between conventional oils and an inhibited turbine oil (Nonpareil) on all types of service. It shows the superior resistance to acid formation in Nonpareil even after 14 years of service.

GET ALL THE FACTS ABOUT THIS UNUSUAL OIL

If your plant is located in one of the states shown below, phone the nearest Standard Oil Company (Indiana) office for a turbine oil specialist. If not, drop us a card. Ask for our Engineering Bulletin number TN571 on Turbine Lubrication with Nonpareil Turbine Oil. In Nebraska, write Standard Oil Company of Nebraska, at Omaha.

COLORADO • ILLINOIS • INDIANA • IOWA • KANSAS • MICHIGAN
MINNESOTA • MISSOURI • MONTANA • NORTH DAKOTA • WYOMING
SOUTH DAKOTA • WISCONSIN

NONPAREIL TURBINE OIL

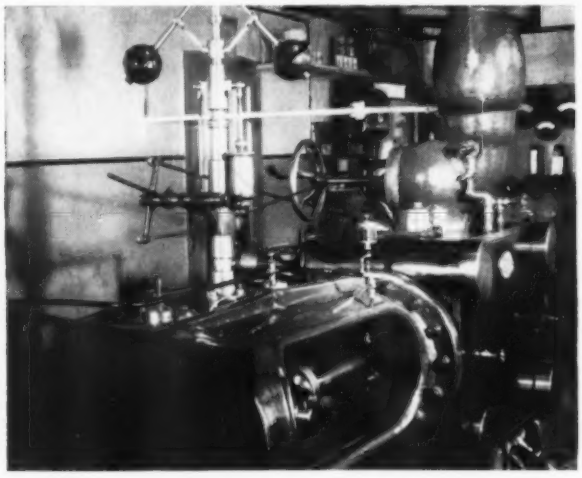
1. Stability Against Oxidation and Sludge.
2. Non-Corrosive. 3. Good Demulsibility.
4. Proper Viscosity Grades.

OIL IS AMMUNITION . . . USE IT WISELY

STANDARD OIL COMPANY (INDIANA)

ONLY 2 SETS OF RINGS IN 40 YEARS WITH STANDARD STEAM CYLINDER OILS

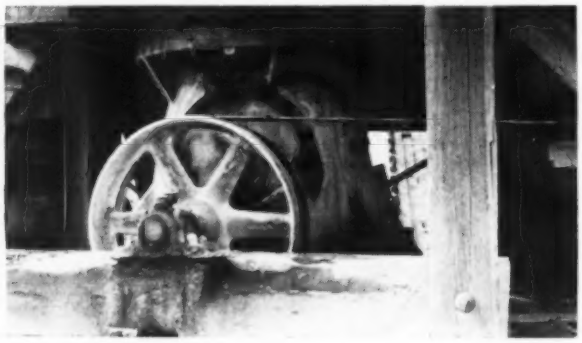
That's the kind of maintenance-reducing results that will help you meet today's emergency power demands. Here's the whole story. The engine, below, was installed in 1892. Even at that early date a Standard Oil Engineer was asked to recommend a cylinder oil. The engine was started on Capitol Cylinder Oil. To date, only two sets of rings have been replaced and the cylinder has never been rebored. There has never been a shutdown because of lubrication failure in the forty years. In that forty years, too, Standard Oil Engineers have gained

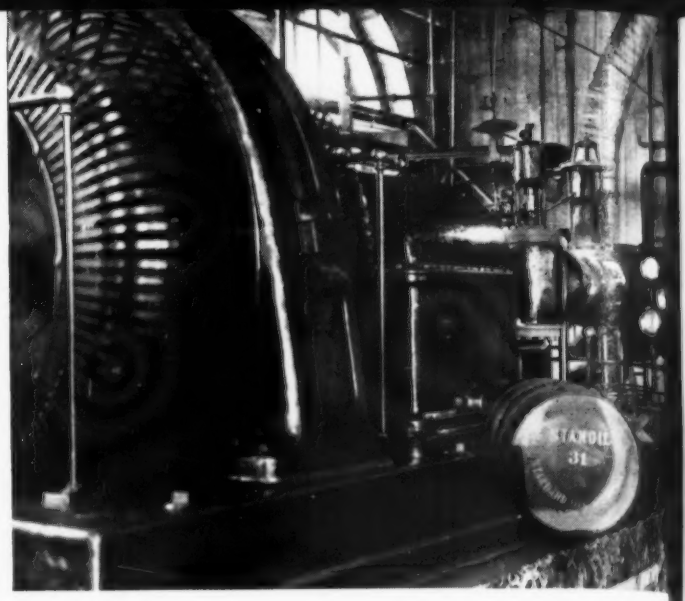


much experience and many new lubricants have been developed. Both are good reasons for turning to these Engineers for help in your present plant maintenance problems.

ALL-WEATHER LUBRICATION WITH SUPERLA GREASE

Because all bearings can't be operated in air-conditioned surroundings, some, like the crusher bearings pictured below, need the all-weather protection of Superla Grease. These bearings had been replaced twice because of overheating in Summer. A Standard Oil Engineer recommended Superla Grease. With it, no bearings have failed Summer or Winter—a saving in scarce material, labor, and productive time.





DOWN-TIME AND UP-KEEP CUT ON GEARED TURBINE WITH STANOIL

Here's what one metal mining and refining company saved when Stanoil cut oil replacements from once a year to once in four years on the geared turbine generator above. One oil system, of 200 gallons capacity, lubricates the 15,000 KW generator, reduction gear, and turbine. Once a year oil had to be changed and the system cleaned to remove deposits. Then Stanoil was tried. When it was replaced after four years, no cleaning had been needed in that time. That meant a saving in shut-down time and labor—that's important, right now. One fill of oil had been used in place of four, a saving of 600 gallons of oil, and a substantial reduction in oil costs had been made, although Stanoil was a higher quality product.

Try a fill of Stanoil in a speed reducer, circulating, or hydraulic system in your plant. Let a Standard Oil Engineer help you pick the application and the right grade of Stanoil. See how it will eliminate some of your labor and maintenance time.

HERE'S WHERE YOU'LL FIND A STANDARD OIL ENGINEER

Just phone any local Standard Oil Company (Indiana) office in the middle western states listed below, or write 910 South Michigan Ave., Chicago, Illinois. In Nebraska call or write Standard Oil Company of Nebraska at Omaha

COLORADO • ILLINOIS • INDIANA • IOWA • KANSAS • MICHIGAN
MINNESOTA • MISSOURI • MONTANA • NORTH DAKOTA
SOUTH DAKOTA • WISCONSIN • WYOMING

OIL IS AMMUNITION...USE IT WISELY

STANDARD OIL COMPANY (INDIANA)

FOR INSULATION . . . EHRET'S 85% MAGNESIA

Be it natural or synthetic, rubber is the *one* best material for tires. Its unique physical properties and characteristics dictate its almost exclusive use on cars, trucks and tractors—both civil and military.

And likewise, in the field of thermal insulation, there is *one* material that has proved itself in service for more than half a century . . . 85% Magnesia. Its high insulation efficiency, workability, light-weight, strength, uniformity, long-life and overall economy are matters of record . . . not of hope or conjecture.

It will pay you to continue to use Ehret's 85% Magnesia.

Conserving heat through adequate insulation is a subject no less timely or important than the conservation of our rubber resources. Write today for your copy of the Ehret 176-page Insulation Handbook.

EHRET MAGNESIA MANUFACTURING CO.

Ehret

VALLEY FORGE, PENNA.

. . . THERE IS AN *EHRET* DISTRIBUTOR OR CONTRACTOR IN EVERY INDUSTRIAL AREA

The Explanation OF A DART'S LONG LIFE

lies in the way it is made

... and here are some important Dart Features

While it has long been well known throughout industry that Dart Unions can be used over and over again, giving tight-joint performance each time, never has the extra-value of Dart Unions been more fully realized than it is right now.

Here are some reasons why Dart Unions give the outstanding performance for which they are famous. First, Darts have extra-wide matched bronze seats that are ground to "true-ball" surfaces. Another important reason is that Dart bodies and nuts are made of High-Test air-refined malleable iron that resists pipe strains, and rough handling.

In the interests of metal conservation, please continue to search your plant for used Dart Unions . . . for, as you know, they can be put back to work. And see your supplier now as you need new ones.

DART UNIONS

E. M. DART MFG. CO., PROVIDENCE, R. I.

Missouri—U. S. Eng, P O Box 97, Memphis, Tenn., awarded contract constructing imprvs, Pemiscot Co, to Markham & Brown, Cape Girardeau, Mo. fencing, to American Steel & Wire Co, 506 Olive St, St Louis. Est under $1,000,000.

N. J., Atlantic City—Civil Aeronautics Admin, La Guardia Field, Jackson Heights, N. Y., awarded contract constructing imprvs, to Union Paving Co, 1227 N Broad St, Phila, Pa., $1,076,779.

New York—U. S. Eng, Chimes Bldg, Syracuse, awarded contract constructing bldg, Oneida Co, to John A Johnson & Sons, 256-41 St, Brooklyn, $1,000,000-$5,000,000.

Ohio—Industrial Company, awarded contract constructing plant, to Rust Eng Co, Clark Bldg, Pittsburgh, Pa., over $2,500,000. Defense Plant Corp will finance.

Ohio—U. S. Eng, Wright Field, Dayton, awarded contract constructing imprvs, bldg, Montgomery Co, to J H Marchbank Co, 205 W Wacker Dr, Chicago, Ill., $750,000-$1,000,000.

Oregon—U. S. Eng, Pittock Blk, Portland, awarded contract constructing bldgs, Deschutes Co, to Smith, Wright & Hoffman, 715 S W Columbia St, Portland, approx $4,000,000.

Pennsylvania—U. S. Eng, P O Box 511, Butler, awarded contract constructing group 1 bldgs, Butler Co, to Lloyds Builders, Inc, Law & Finance Bldg, Pittsburgh. To exceed $2,000,000. Bids soon on Group 2, bldgs, from invited list bidders.

Rhode Island—Yards & Docks, Navy Dept, 18 St and Constitution Ave N W, Wash, D. C., awarded contract constructing addnl facilities at advance base depot, Supplementary Agreement 9, NOY 4175, to George A Fuller Co, and Merritt-Chapman & Scott Corp, 597 Madison Ave, New York, N. Y. $18,478,000.

South Carolina—U. S. Eng, 33 Customhouse, Charleston, awarded contract constructing bldgs, Berkeley Co, to Daniel Constr Co, Greenville, $500,000-$1,000,000.

Tennessee—U. S. Eng, 494 Spring St N W, Atlanta, Ga., awarded contract constructing imprvs, Davidson Co, to Wolfe-Michael Co, 1021 Heywood St, Memphis, under $1,000,000.

Tennessee—U. S. Eng, 306 U S Courthouse, Nashville, awarded contract constructing temporary frame bldgs, outside utility connections, Henry Co, to Rock City Constr Co, 135 4 Ave, N Nashville, under $1,000,000.

Tennessee—U. S. Eng. U. S. Courthouse & Customhouse, Mobile, Ala., awarded contract constructing imprvs, Shelby Co, to A. Farnell Blair, Decatur, Ga. Est $5,000,000.

Tennessee—U. S. Eng, 306 U. S. Courthouse, Nashville, awarded contract constructing bldgs, Montgomery Co, to Foster & Creighton Co, American Natl Bank Bldg, Nashville, under $1,000,000.

Texas—Defense Plant Corp, 811 Vermont Ave N W, Wash, D. C., awarded contract constructing addnl plant facilities, to Foster-Wheeler Corp, 624 Shell Bldg, Houston, $2,500,000. Industrial company will operate. H Lloyd, 2006 W Alabama Ave, Houston, archt.

Texas—U. S. Eng, Fort Sam Houston, awarded contract constructing bldgs, Spec 42-388, Bell Co, to Hagstrom Constr Co, Professional Bldg, Temple, $1,000,000-$5,000,000.

Tex., Dallas—Mid-City Realty Co, P O Box 598, awarded contract constructing 20x400 ft, factory bldg unit, re-modeling, etc, automatic sprinkler sys, air conditioning, electrical facilities, wiring etc, to Henger Const Co, Dallas Natl Bank Bldg, Dallas, approx $92,000.

...YOU HELPED US WIN IT

Without your help, we could not have gained the high honor of the Army-Navy "E" production award. Your co-operation permitted us to produce the valves it took.

More than 3,000 go into every battleship. How many do you think are needed to build America's *two-ocean* Navy? The ever-growing Liberty maritime fleet? How many thousands more for barracks, cantonments, and plants turning out Army equipment?

Doubled and re-doubled were our facilities beginning even before the war. Yet, only because you helped, were we able to meet the vast demands for Crane valves.

You made that possible by conserving the valves installed in your lines—by giving them the best of care—by *"making them do"* in the face of critical materials shortages. And most likely, as so many plants are doing, by utilizing the valuable tips in Crane "Piping Pointers" Bulletins on getting better and longer service from piping equipment.

As a result, on both industrial and fighting fronts, more and more Crane valves are today quickening the pace of America's march to Victory—assuring dependable flow control of every vital fluid.

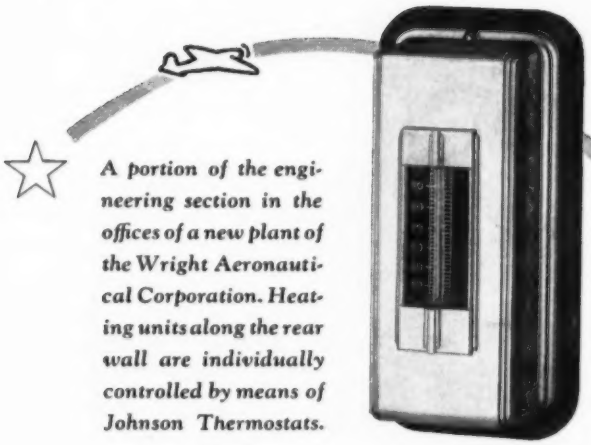
And here at Crane, the Army-Navy "E" is spurring us on in making even more valves—helping us get our part and your part of this wartime job done faster.

Crane Co., 836 South Michigan Ave., Chicago, Illinois

"Piping Pointers" Bulletins—one of Crane Co.'s wartime aids to industry for getting better and longer service from valves. Supplied free on request.

CRANE VALVES

Effective



A portion of the engineering section in the offices of a new plant of the Wright Aeronautical Corporation. Heating units along the rear wall are individually controlled by means of Johnson Thermostats.

TEMPERATURE CONTROL FOR BUSY WAR PLANTS

For every phase of temperature control in war production . . . work spaces, test rooms, and processing chambers, Johnson Control assures effective, efficient operation.

Johnson *Precision-Planned* Thermostats and Humidostats provide effective control at any desired temperature and humidity. Johnson covers the entire field of temperature control, from a simple unit heater installation to a complete system for providing varied temperature and humidity conditions throughout an entire plant. Each job is handled, from design to installation, by Johnson men . . . each job is "Engineered" to deliver effective, dependable control, no matter what the conditions.

If you have a process control, air-conditioning, heating or humidifying problem, get in touch with the nearest Johnson office, or wire for bulletins describing equipment to meet your needs.

JOHNSON SERVICE COMPANY • MILWAUKEE, WISCONSIN

Direct Branches in all Principal Cities

Washington—Civil Aeronautics Admin, 7 Regional Office, Boeing Field, Seattle, awarded contract constructing imprvs, to Minnis & Moody, Johnson, Inc, and Vista Constr & Finance Co, P O Box 781, San Bernardino, Calif., $2,418,744.

Washington—U. S. Eng, 800 3 Ave, Seattle, awarded contract constructing steam plant bldg, Spokane Co, to Clynde M Ludberg Co, W 326 1st St, Spokane, $100,000-$500,000.

Outside United States—Yards & Docks, Navy Dept, 18 St and Constitution Ave N W, Wash, D. C., awarded contract constructing addnl facilities, to James Stewart & Co, Inc, and H J Deutschbein Co, and Peter F Connolly Co, 230 Park Ave, New York, N. Y., $1,500,000.

Outside United States—Yards & Docks, Navy Dept, 18 St and Constitution Ave N W, Wash, D. C., awarded contract constructing addnl facilities, to Lindgren & Swinerton, Inc, Hegeman Harris Co, Inc, and Tucker McClure, 220 E 42 St, New York, N. Y., $6,276,000.

South America, Peru—Vanadium Corp, 420 Lexington Ave, New York, N. Y., awarded contract constructing plant, to Rust Eng Co, Clark Bldg, Pittsburgh, Pa. Est $4,000,000. Defense Plant Corp, Wash, D. C., will finance.

New Equipment

(*Continued from page* 134)

ductors, saving delay in securing large cables. Units are designed to take care of extensions, additional jobs, or rearrangements. Open wiring support is furnished for cable sizes from No. 6 to 2,000,000 cm, and with separable bases for flat surface, beam or pipe mounting. *Delta-Star Electric Co, Fulton St, Chicago, Ill.*

Solenoid Motor Starter

THERMALOAD V SOLENOID MOTOR STARTER recently announced by company adds to a solenoid-type starter many of features formerly found only on larger controls. The most notable feature is the Monitor bi-metal compensated overload relay. This permits perfect starter operation under extremes of ambient temperature. Full overload

ROCKBESTOS A.V.C.

Prevents Shutdowns because

IT CAN'T GET A "HEAT RASH"

If repeated wire-failures in circuits around boilers, steam lines, furnaces, lehrs, soaking pits, kilns, etc., are slowing down your production, it will pay you to investigate Rockbestos A.V.C. — the wire with insulation that stands up in the most severe hot-spot installations.

Why does Rockbestos A.V.C. stand up in such service? Because the permanent asbestos braid and felted asbestos insulation is heatproof and fireproof, and won't bake brittle, burn, rot, swell or flow.

Eliminate down-time caused by continual wire maintenance by installing Rockbestos A.V.C. wire, cable or cord in your plant's hot-spots. Our engineers will gladly make recommendations from a line of 122 permanently insulated constructions.

When inquiring or ordering, give end-use classification and authorized priority preference rating. For full information write nearest branch office, or:

Rockbestos Products Corp., 883 Nicoll St., New Haven, Conn.

Why Rockbestos Permanent Insulation provides dependable wire performance

Rockbestos A.V.C. Power Cable above and similarly insulated Motor Lead Cable (Underwriters' and Nat. Elec. Code, Type AVA) has a maximum operating temperature rating of 110°C. (230°F.) and this permanently insulated construction.

1. A tough, rugged asbestos braid, resistant to heat, flame, moisture, oil, grease and corrosive fumes.
2. Outer felted asbestos wall which serves as a heat-barrier against high ambient temperatures.
3. Lubricated varnished cambric for high dielectric strength and added moisture resistance, protected from heat and flame by two felted asbestos walls.
4. Felted asbestos insulation that withstands conductor-heating overloads and won't burn even when exposed to copper-melting arcs.
5. The conductor is perfectly and permanently centred in helically applied insulation.

One of 122 different wires and cables developed for severe operating conditions.

WON'T bake brittle, bloom, burn or rot
RESISTS moisture, oil, grease and fumes

ROCKBESTOS A.V.C.
The Wire with Permanent Insulation

NEW YORK, BUFFALO, CLEVELAND, CHICAGO, PITTSBURGH, ST. LOUIS, LOS ANGELES, SAN FRANCISCO, SEATTLE, PORTLAND, ORE.

MURRAY EQUIPMENT

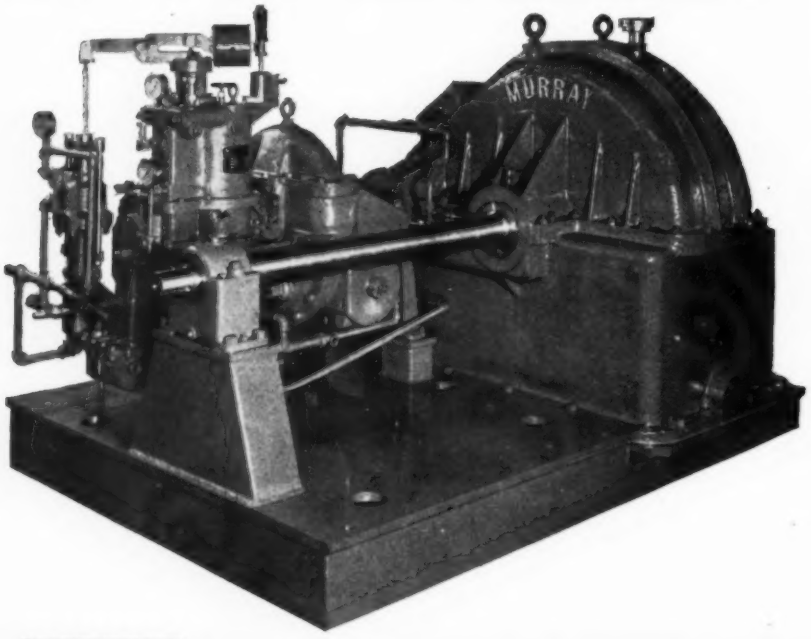
Our job has always been to aid production through dependable power facilities

● Today, with expanded facilities, this organization is making its greatest production effort to help the war industry step up its power capacity.

High priority ratings now determine where Murray Equipment goes. That, of course, is only for the duration. When the tomorrow comes that brings Victory and peace, Murray Equipment again will be available to all. It is for that time that we suggest you now acquaint yourself with Murray Equipment and learn its possibilities.

Murray Bulletins that give complete details of Murray Equipment will be sent to you upon request. Look them over, then file them for future reference.

BOILERS . . . . . TURBO GENERATORS
MECHANICAL DRIVE TURBINES
ENGINES . . . UNIT HEATERS . . . GEARS



BOILERS TURBINES ENGINES

MURRAY
IRON WORKS COMPANY
INCORPORATED 1870
BURLINGTON IOWA

protection assured because the trip always occurs within the same time at a given percentage of overload. A further safeguard for the motor is a unique arrangement which prevents operator from improvising any method to hold starter button in the "ON" position, thus preventing the trip when overload occurs. The operator must press the button and release it before contact is made. Other features include vertical, straight-line design; resilient, shock-proof mounting that eliminates hum; double-break contacts of pure silver; coils that are easily interchangeable for different voltages. Unit has been tested and approved by the Underwriters' Laboratory. Available in five sizes—1.5 to 7.5 hp, and 110 to 550 volts, ac. *Monitor Controller Co, Baltimore, Md.*

Rotary Pump

ROTARY PUMP is vertically mounted and powered by a 15-hp gearhead motor. Practically all pumps being made now are going into marine construction and are built to meet full Navy specifications. However, because of small floor space required for mounting, this unit has been adopted for use in industrial plants requiring the transfer of oils and other non-abrasive liquids. The general specifications are: Capacity 100 gpm at a pressure of 100 psi, handling diesel fuel. The pumping unit is all bronze construction. The motor is standard gearhead design, 1770 rpm, reducing to 440 rpm on the drive shaft. The base is fabricated steel, designed for bottom and back anchorage in mounting. *Blackmer Pump Co, Grand Rapids, Mich.*

Circulating Pumps

COMPANY ANNOUNCES NEW CIRCULATING PUMPS, including ¾-in. and 1-in. side-wall-mounted types, a 1¼-in. side-wall-mounted type for low-submergence applications, and a 1¼-in. horizontal type. Pumps are applicable to evaporative condensers, air-conditioning units, washers, as well as other machinery requiring a circulating unit. New machines are additions to the line of pumps previously available which included ¾-, 1- and 1½-in. immersion-type pumps, and a 1¼-in. side-wall-mounted unit. *Ingersoll-Rand Co, 11 Broadway, New York, N. Y.*

Snubber Calculator

SLIDE-RULE-TYPE SELECTOR is a time-saver for engine operators in choosing the right size Burgess exhaust snubbers to provide quiet exhausts for their engines. Unit works similarly to a slide

SABOTAGE! DON'T ALLOW ANY OF YOUR MEN TO FORCE A VALVE

Failure to close off is usually caused by foreign matter lodged on the seat. Usually it clears away when the valve is opened part way to flush it.

Don't try force to close it off. That may scar disc and seat—giving you a permanent leak of another sort—and even though seats and discs require relatively little material, the metal they use is on the critical list. Waiting for new parts might cripple plant efficiency—sabotage, in wartime.

Where do your men apply grease, lead or paint to valve connections?

Instruct them when reassembling valves to their lines to put joint compound on the *pipe* threads—*not* on the valve threads from where the excess will be forced inside the valve and possibly onto the valve seat.

Before reassembly, see that valve and line are *both* blown out—or seats may be ruined by dirt and grit.

Write to Reading, Pa., general office, for copy of "VALVE DON'TS" —a poster for plant use that tells things NOT to do to valves.

READING-PRATT & CADY

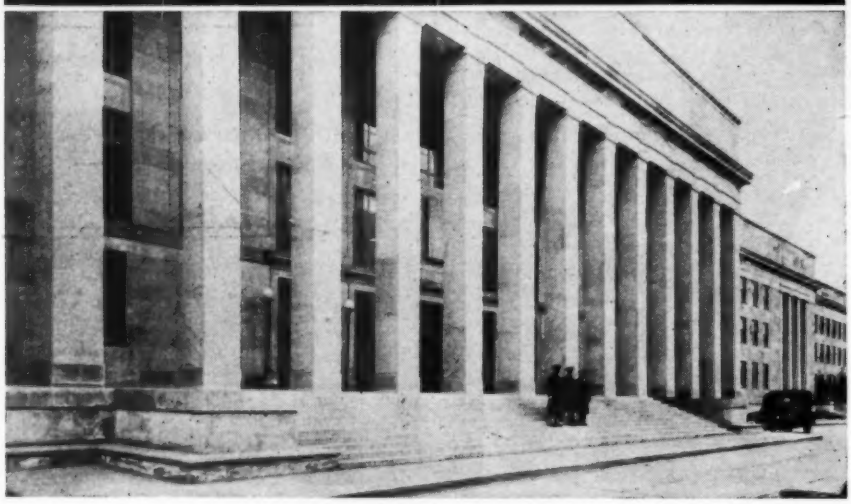
MANUFACTURERS OF
READING CAST STEEL VALVES AND FITTINGS • PRATT & CADY BRASS AND IRON VALVES
D'ESTE VALVE AND ENGINEERING SPECIALTIES

Reading, Pa., Atlanta, Boston, Chicago, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, San Francisco

A DIVISION OF AMERICAN CHAIN & CABLE COMPANY, Inc., BRIDGEPORT, CONNECTICUT

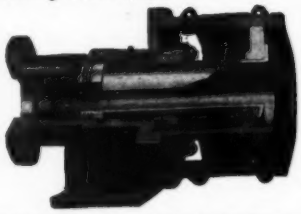
ADSCO PISTON-RING EXPANSION JOINT

INSTALLED IN THE NEW PENTAGON BUILDING



Charles S. Leopold, Mechanical Engineer
Baker Smith & Co., Mehring and Hanson, Heating Contractors

Fully guided internally and externally. Available in single or double joints for high pressure and high temperatures; flanged or beveled ends.



ONLY SLIP-TYPE JOINTS THAT MAY BE UNPACKED AND REPACKED UNDER PRESSURE.

• Of all places where costly line shut downs must be avoided, Washington's big, busy Pentagon Building is a typical example.

That's why here you'll find ADSCO Piston-Ring Expansion Joints. Only slip-type joints of their kind that can be unpacked and repacked under pressure, thereby eliminating interruptions to service.

For steam, hot water, oil or gas lines, specify this modern expansion joint that is always on the job. Write for bulletin 35-15PR.

AMERICAN DISTRICT STEAM COMPANY
NORTH TONAWANDA, NEW YORK
Makers of "UP-TO-DATE" Steam Line Equipment For Over 60 Years

rule and makes it easy for any engine operator to make preliminary selection from the engine data presented. Company states that selection can then be approved by Burgess engineers who are still available for the more difficult applications. *Acoustics Division, Burgess Battery Co, 2815 W Roscoe St, Chicago, Ill.*

Voltage Regulator

GL-1 VOLTAGE REGULATOR is applicable to individual small ac generating plants having separate exciters. This regulator will satisfactorily control individual generating units operating in parallel with other generating units by using automatic cross-current compensation. The maximum size generating unit which the GL-1 regulator unit will control is limited largely by the field current of the exciter. This regulator should not be used on an exciter whose maximum field current exceeds 1.4 amp at maximum exciter voltage, while exciter is connected to alternator field (125-volt exciter). The regulator is suitable for the control of single two- or three-phase alternators, and is normally furnished for 50- to 60-cycle operation. Can be furnished for 110-120 volts, or for 208-240 volts. *Burlington Instrument Corp, Burlington, Iowa.*

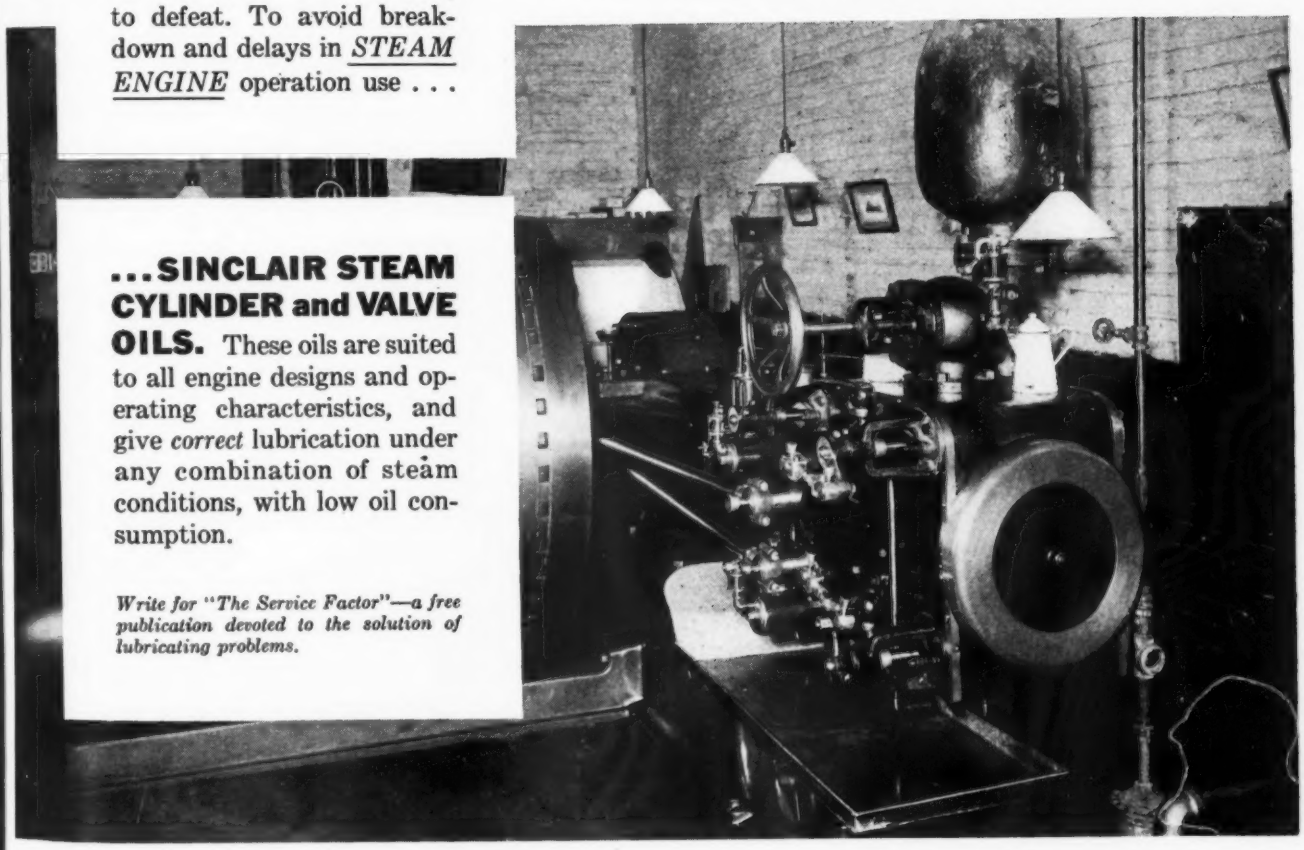
Oil Purifier

THROUGH a typographical error, copy for the Hoan-Crane oil purifier and oil clarifier (POWER Mid-December, 1942, page 70, items No. 6 and 7) was transposed. Item No. 7, an oil purifier, refers to illustration No. 6 and item No. 6 refers to drawing numbered 7.

Standby Batteries

IN VITRABLOC JAR, rubber has been replaced by a vitrified ceramic composed entirely of non-critical materials. Line offers same capacities and virtually all advantages of the rubber-jar battery developed by company about three years ago for telephone and standby use. Company states that unit is considered not as a substitute, but as a permanent improvement and addition to the company line. Like glass, Vitrabloc doesn't absorb moisture, nor will acid penertate or affect it. Even when heated to 212 F and then plunged into ice water, there is no contraction of the jar. The unit is explosion-proof and can be set up next to other electrical equipment. Makers state that (as of Dec 17, 1942) deliveries on the new Vitrabloc batteries can be made on an A-3 priority. *Philco Corp, Philadelphia, Pa.*

BREAK THROUGH leads to success—*breakdown*, to defeat. To avoid breakdown and delays in *STEAM ENGINE* operation use . . .



. . . SINCLAIR STEAM CYLINDER and VALVE OILS. These oils are suited to all engine designs and operating characteristics, and give *correct* lubrication under any combination of steam conditions, with low oil consumption.

Write for "The Service Factor"—a free publication devoted to the solution of lubricating problems.

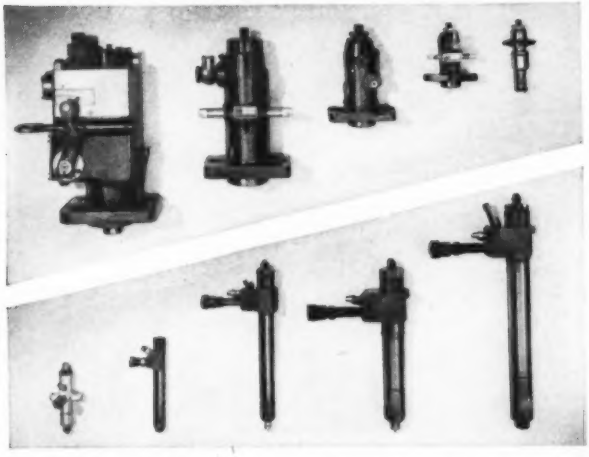
SINCLAIR INDUSTRIAL OILS

FOR FULL INFORMATION OR LUBRICATION COUNSEL WRITE NEAREST SINCLAIR OFFICE

SINCLAIR REFINING COMPANY (Inc.)

2540 West Cermak Road, Chicago • 10 West 51st Street, New York City • Rialto Bldg., Kansas City • 573 West Peachtree Street, Atlanta • Fair Building, Ft. Worth

YOUR GUARANTEE OF THE FINEST IN DIESEL FUEL INJECTION EQUIPMENT



In every detail, Adeco fuel injection pumps, nozzles and nozzle holders reflect the experience in precision design and workmanship of the Adeco organization, pioneers of diesel injection equipment in this country.

Today, Adeco offers a wide range of standard and special fuel injection equipment, precision-built for the most rigid diesel requirements.

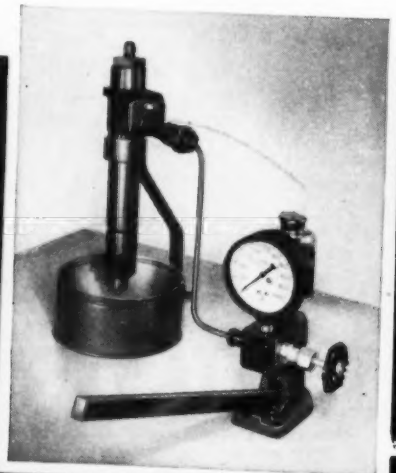
Typical of the Adeco line are the single unit fuel injection pumps and fuel injectors illustrated here. Nothing is spared to make products bearing the Adeco nameplate the finest in dependable fuel injection equipment.

VITAL FOR MAINTENANCE

ADECO NOZZLE TESTER

America's most widely used Nozzle Tester makes it easy for any mechanic to make quick, accurate tests on injector opening pressure, spray pattern, stuck needle valves, and leakage around valve seats. Compact, portable, sturdy, precision-built. Pressures up to 10,000 p.s.i. Tests all makes of injectors. Avoids costly delays and possible damage to injector tips. Best for economical maintenance.

Write for new illustrated bulletin



AIRCRAFT & DIESEL EQUIPMENT CORPORATION
4401 NORTH RAVENSWOOD AVENUE • CHICAGO, ILLINOIS

Engineers' Books

Fire Brigades

THE ORGANIZATION AND TRAINING OF INDUSTRIAL FIRE BRIGADES *By Captain John C Klinck of the Memphis Fire Department, Published by S C Toof & Co, Memphis, Tenn., 119 pages, 6x9 in., fully illustrated, paper binding. Regular price $1.00 per copy, discount for quantities when ordering for employee fire brigades.*

This practical illustrated handbook is suitable for students and was written to provide instructors with an illustrated outline as a guide to form and train private fire brigades. It covers such subjects as brigade organization, firemen's clothing, tools and equipment, communication and alarm systems, rescue work, salvage operations, ventilation of fires, the handling of hose and ladders, as well as describing various fire extinguishers.

Cross-sections show the internal parts of hand extinguishers and the methods used to separate the different solutions. Considerable space is allotted to the care, storage, and handling of hose, nozzles and connectors.

Carrying and raising extension ladders and how to carry hose up these ladders are illustrated in complete detail. Pictures also show how the tools are used to force entry through locked doors and how to make roof openings for ventilation.

Although this book is a valuable addition to the works on fire protection it leans to a great extent toward extinguishing debris and building fires. Directed as it is toward industrial fire protection complete instructions on the correct way of using hand extinguishers and the best methods of fighting oil and chemical fires at their incipiency would have increased the value of this book for the beginner.

E W F

Questions and Answers

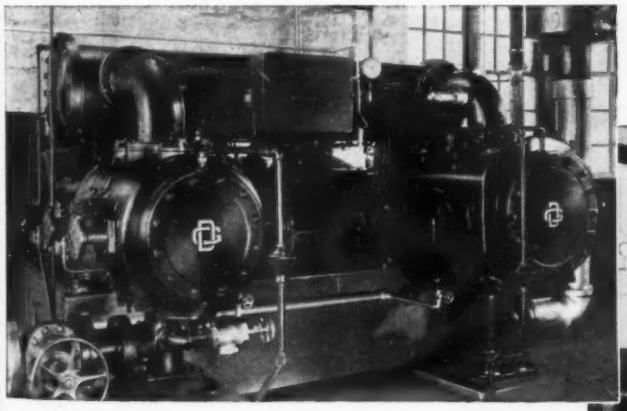
ENGINEERING QUESTIONS AND ANSWERS *Vol. III—By the staff of Mechanical World, published by Emmott & Co. Ltd, 78 Palatine Road, Manchester. 20. 176 pages, 7x10 in. fully illustrated. Price approximately $1.25.*

This third volume continues the record in permanent form of questions and the correct answers, submitted to "Mechanical World." The subject matter is wide and as an aid to reference an index is added. The value of this collection lies in the fact that the questions all arose out of difficulties

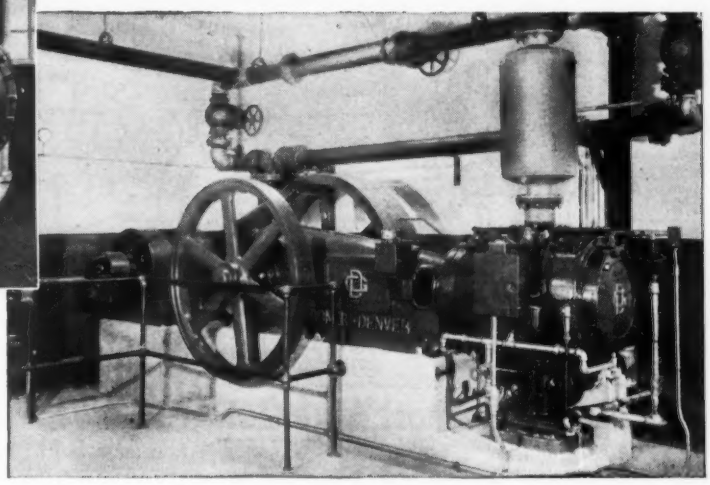
More POWER Behind Your Manpower!!

IN today's production battle, every man-hour counts for more when it's backed by plenty of power. Gardner-Denver Horizontal Compressors have long been famous as an ever-ready source of compressed air power. They're proving themselves under the grind of continuous operation in scores of war plants today—taking in stride the extra hours—the extra demands for air output.

Their dependable performance is based on such advanced design features as extra rugged frame construction . . . Timken roller main bearings . . . entirely automatic capacity control.



Designed for unusually low horsepower requirements—Gardner-Denver "RX" Single-Stage Horizontal Air Compressors are built in capacities from 89 to 1292 cubic feet displacement per minute.

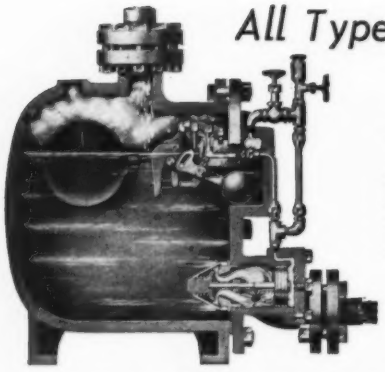


Engineered for continuous heavy-duty performance—the Gardner-Denver "HA" Two-Stage Horizontal Air Compressor is built in capacities from 468 to 1854 cubic feet displacement per minute.

Write for bulletin giving complete information on Gardner-Denver "HA" Two-Stage and "RX" Single-Stage Horizontal Air Compressors. Gardner-Denver Company, Quincy, Illinois

GARDNER-DENVER *Since 1859*

All Types of NICHOLSON TRAPS Deliver Super-Service

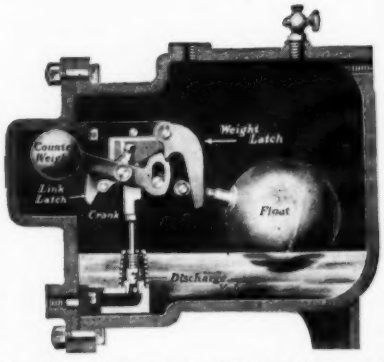


PISTON OPERATED

A compact trap with super capacity. Positive, instantaneous, non-wire-drawing discharge valve—entirely open or fully closed at all times. Stainless steel valves, seats and all working parts. For super-pressures and super-heat, specify Nicholson piston operated traps.

WEIGHT OPERATED

Positive automatic intermittent action. Large capacity. Pressures to 1500 lbs. at 1000 degree max. temp. Meets ALL requirements of modern high pressure power plants.



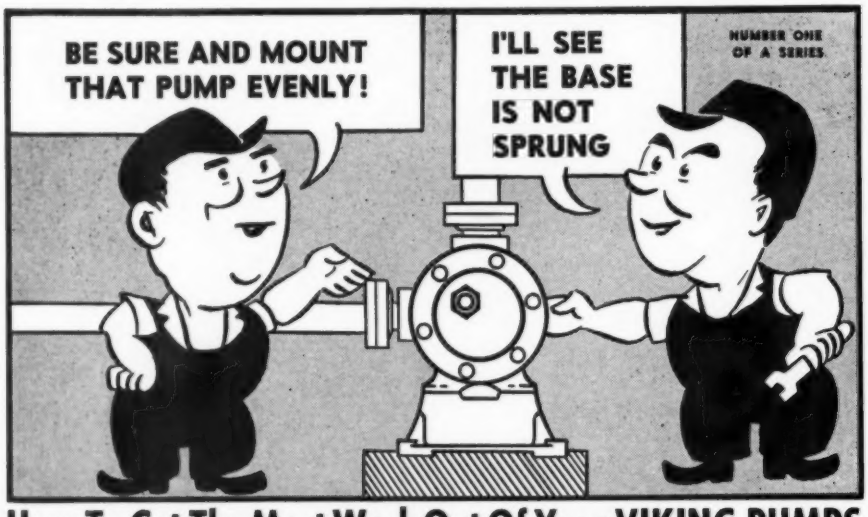
THERMOSTATIC models are non air-binding . . . freeze-proof . . . non dribbling . . . require no adjustments . . . never waterlog. Large capacity. Four types. Sizes ¼" to 2". Pressures from vacuum to 300 lbs.

CATALOG NO. 941—W. H. NICHOLSON & CO., 125 OREGON ST., WILKES-BARRE, PA

NICHOLSON Traps

THERMOSTATIC ▼ PISTON AND WEIGHT-OPERATED STEAM GASOLINE AND COMPRESSED AIR TRAPS

CONTROL VALVES ▼ FLOATS ▼ MANDRELS ▼ STEAM AND AIR SEPARATORS



How To Get The Most Work Out Of Your VIKING PUMPS

When mounting a Viking Rotary Pump and bolting it down, be sure that the base is not sprung. Bolting the pump down over an uneven surface may cause binding and heating in the stuffing box. It may cause working parts of the pump to bind and wear beyond repair in a short time. The pump must be free enough to turn the shaft by hand.

Get *extra* wear out of your Viking Pumps by giving them *extra* care. The Viking Service Manual tells you how. It's a handy, illustrated booklet giving you practical help in mounting, operating and maintaining Viking Pumps. Write for your copy today. It's FREE.

VIKING PUMPS — FIRST IN AMERICA

VIKING Pump COMPANY
CEDAR FALLS, IOWA

encountered by engineers in the course of their work.

Electricity

ELECTRICAL BUSES AND BUS STRUCTURES *By William Deans, chief engineer, I-T-E Circuit Breaker Co. Published by I-T-E Circuit Breaker Co, Philadelphia, Pa., 24 pages, 8½x11 in.; illustrated; stiff paper cover. Available free on request.*

During a period like the present when saving of copper and other critical materials is a necessity a book like this has a special interest. An electrical busbar correctly designed, as this book shows, uses the economical and mechanical minimum of material. Engineers who have no busbar design problems will find this thorough treatment interesting and helpful because of the practical information given on heavy electrical circuits and busbars that every operating and industrial engineer should know. This is the first really comprehensive treatment of the subject that has been made available and coming at this critical period makes it doubly valuable.

Specifications

SPECIFICATIONS FOR STEEL PIPING MATERIALS (1942). *Prepared by Committee A-1 on Steel. Published by the American Society for Testing Materials, 260 S Broad St, Philadelphia, Pa. 256 pages, 6x9 in., 90 tables, 28 diagrams, stiff paper binding. Price $1.75.*

For the first time, the American Society for Testing Materials has compiled in one compact volume all of its specifications covering steel piping materials, most of the standards having been developed through the work of Committee A-1 on Steel. Ten of the specifications cover boiler, superheater and miscellaneous tubes, many of which are incorporated in the ASME Boiler Code and other codes.

There are five specifications covering castings, widely used for valves and related materials; four pertaining to forgings and fittings; three covering carbon and alloy-steel nuts and bolting material. For convenience, the standard austenite grain size chart (E 19) is embodied in the book.

To expedite procurement and conserve critical materials, many ASTM emergency alternate provisions have been issued in the piping field. These

POWER
-packaged for Victory

DEADLY in its compact power—this carrier-based plane provides the sting that makes great naval air victories possible.

"A motor with wings," it has been aptly termed, for a single engine of more than 2,000 horsepower roars this mighty ship to Victory.

Engines of such tremendous horsepower are possible because of new techniques in engineering and manufacture, not the least of which have been the advances made in the Foote Bros. Gears that power them. For an engine of this size—swinging propellers at high speed offers problems in gear design and manufacture that, until a few months ago, might well have been considered unsolvable.

How well these problems were solved is evidenced by the flow of Pratt & Whitney engines rolling off production lines in huge engine plants throughout the country. The extreme precision of the gears is a tribute to the engineering back of them, but even more to the new methods of manufacture that have made their mass production possible.

When the war is won these gears, produced in the Precision Gear Plant of Foote Bros., can be applied to peacetime engines and peacetime machines. Manufacturers are then assured of a new era in the transmission of power through gears and speed reducers—an era of more compact, more efficient machines.

FOOTE BROS. GEAR AND MACHINE CORPORATION
5301 South Western Boulevard • Chicago, Illinois

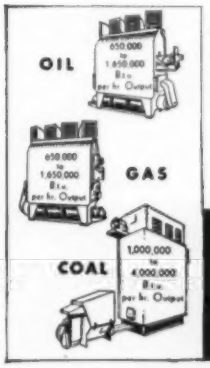
FOOTE BROS.

Better Power Transmission Through Better Gears

The War Tempo demands methods that save man hours, materials and money. Dravo direct fired Heaters start warm air in circulation at the snap of a switch. High heat transfer efficiencies make them most economical to operate. Fuels are gas, light and heavy oil, coke oven gas, and anthracite or bituminous coal.

NOW! COAL-FIRED, SELF CONTAINED . . . DRAVO DIRECT FIRED HEATERS

THIS coal-burning heater is a self-fired unit containing its own combustion chamber as well as the motors and fans to circulate warm air in the space to be heated. It is a "life saver" for those sections of the country where coal is the only available fuel. One or more heaters of this type can be arranged to provide working temperatures for any size or shape of industrial building. Such a system offers advantages of quick installation, lower cost than central steam plant, and flexibility in use to provide temporary heat or a permanent heating system.



Note—the heater shown above is hopper fed; bin fed models are also available; 9 sizes of self contained units, output capacities from 1,000,000 to 4,000,000 B.t.u. per hour output.

Write to us for catalog and specification sheets on types you wish to consider.

DRAVO CORPORATION
HEATER DEPARTMENT
Sales Offices in Principal Cities
DRAVO BUILDING PITTSBURGH, PA.

ALLPAX
THE PACKING THAT "PACKS ALL"
. . . use it once and
. . . you'll use it always

THE ALLPAX CO., INC.
Mamaroneck, N. Y.
•
Distributors Everywhere

Here's the universal packing that can be used for any fluid or on any apparatus. One size packs all—economically, efficiently—tightly—simply.

Try ALLPAX and you, too, will be enthusiastic over its easy application and long wear. You don't have to remove old packing to repack with ALLPAX. Square cross section makes ALLPAX easy-filling in any stuffing box.

Try it and you'll always use it. Full details on request.

provisions are incorporated as part of this book.

Leather Belting

HOW TO GET THE MOST FROM YOUR LEATHER BELTING *Published by American Leather Belting Association, 53 Park Row, New York, N. Y. 26 pages, 5½x7½ in. illustrated, tables, paper binding. Available free on request.*

Here is a little book that everyone interested in leather belting should have. It is packed from cover to cover with practical ideas on the application and care of leather belts. Subjects covered include how to order leather belts, how to determine the size of leather belt required for a given drive, how to install leather belts correctly how to make leather belts endless, how to maintain leather belts, how to shorten leather belts, how to align shafting and pulleys, etc. In these times when production and more production is the keynote of practically every plant, this little book will be unusually helpful.

Psychology

PSYCHOLOGY FOR BUSINESS AND INDUSTRY, (2nd edition—1942) *By Herbert Moore Ph D, consultant, Business Research Corp, and lecturer, University College, University of Chicago. Published by McGraw-Hill Book Co, 330 West 42nd St, New York, N. Y., 526 pages, 6x9 in., 145 tables, 47 illustrations, cloth binding. Price $4.00.*

The author has placed emphasis on the aspects of psychology which have been shown to be of value in business and industrial personnel problems. Extensive use has been made of private publications and reports from private organizations on their methods of handling employee relationship.

Some important chapter headings include the importance of proper selection, how to choose a person that will fit into the organization, hiring and examination, how to plan the interview and carry out ability tests, and the value of proper training. The need for training is common to all jobs but each has its own problems as to how this training will be planned and carried out. Stressing the need of skill in meeting these needs the author continues by discussing all other pertinent problems encountered in employee relations.

Anyone faced with the problems of selecting, testing, examining, and train-

In War Industries and in Power Plants
In Fighting, Transport and Merchant Ships
In War Transportation, Locomotives and Other Units

GLOBE STEEL TUBES IN GLOBAL-WAR SERVICE

The "emergency" found *Globe Steel Tubes* prepared... prepared because *Globe* engineers are veterans of more than 30 years' constant service on the pressure-tube "front."... Concentrating now, as always, on *Globe Quality* steel tubes, we faced no problem of "conversion" to meet the unprecedented demands of industry's war-production power plants... transport, merchant and warships... locomotives and other units of war power-equipment requiring super-quality and 24-hour-a-day operative ability in boiler tubes, condenser and heat-exchanger tubes, stainless and mechanical tubing.

GLOBE engineers offer their long experience and superior facilities to aid you in selecting steel tubes of proper characteristics for your specific needs.

GLOBE TUBES

★ STAINLESS TUBES
★ BOILER TUBES
★ GLOBEIRON TUBING
★ GLOWELD TUBES
★ CONDENSER AND HEAT EXCHANGER TUBES
★ MECHANICAL TUBING

GLOBE STEEL Tubes

GLOBE STEEL TUBES CO., *Milwaukee, Wisconsin, U.S.A.*

ROTO

Cleans Tubes Thoroughly with *Less Down Time*

Straight tubes, curved tubes, in boilers, superheaters, transfer lines, economizers and condensers—to keep your plant running efficiently you've got to keep them clean.

Roto packs ample power for fast descaling. With the Roto operating air valve the operator himself controls the air supply at the tool, eliminating a helper and saving the time ordinarily wasted signalling between them.

Cut cleaning costs and "down time" to a minimum with Roto Tube Cleaners. Send for details.

The ROTO Company

145 Sussex Ave., Newark, N. J.

BETTER SERVICE — SAFETY — SATISFACTION
FOR REPLACEMENTS ORDER

PRECISION GAGE GLASSES and GAGE GLASS GASKETS THAT WILL NOT BLOW OUT

Standard Square Cut Gaskets High Pressure Non-hardening and Non-softening

GASKETS THAT WILL FIT EXACTLY

Red Lip-mold Pattern Expansion Type Gasket

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ERNST WATER COLUMN & GAGE CO.
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ing in a supervisory capacity will receive valuable suggestions from a study of this book. Rapid promotions, occurring during the recent industrial expansion, have placed many inexperienced persons in supervisory positions and the practical methods and experiences of other organizations outlined in this book will assist the new foreman or superintendent in meeting the demands of his new job.

A C Circuits

ALTERNATING-CURRENT CIRCUITS — (1942). *By Earl M Morecock, Supervisor of Electrical Department, Rochester Athenaeum and Mechanics Institute. Published by Harper & Brothers, 49 E 33rd St, New York, N. Y. 175 pages, 6 x 9 in., illustrated, cloth binding. Price $2.75.*

A series of textbooks has been prepared by the faculty of Rochester Athenaeum and Mechanics Institute as part of its program for developing teaching materials which are functional and closely related to industrial requirements. This book is one of these texts and has been prepared for use in technical institutes, junior colleges, and in industrial and extension schools. Like in most texts, the treatment is largely theoretical and assumes a knowledge of algebra and trigonometry by the student. It is divided into four chapters: alternating current waves and quantities, vector and complexed quantities, single-phase systems and polyphase systems. In addition there are included suggestions for study and laboratory procedure, instructions for laboratory report writing and for plotting graphs. Examples with their detailed solutions, followed by problems of a similar nature are inserted at frequent intervals throughout the text. These enable the student to test his ability to read and understand the material just preceding the problems. Other problems are placed at the end of the chapters for review. Answers to all test problems are given in an appendix, which makes the book well suited to those who have to depend for self study to further their education.

Heat

HEAT—2nd edition, 1942. *By James M Cork, Professor of Physics, University of Michigan. Published by John Wiley & Sons, Inc, New York. Cloth 6 x 9 in., 294 pages, 128 figures. Price $3.50*

Written somewhat more from the standpoint of the physicist than from

TO ELECTRICAL MEN EVERYWHERE

You Can Save Even More Copper than We Can

IN many respects, copper is more valuable than gold. For without it, we, as manufacturers, cannot produce the machines that keep plants humming; without vast amounts of it we cannot produce the electric equipment needed in such large volume by the Army and Navy.

In every G-E plant—in every G-E design office—we are spending thousands of man-hours to the end that not one pound of the "electrical" metal shall be wasted. Our engineers in the field have a similar objective—to help you save copper in the *application* of electric equipment.

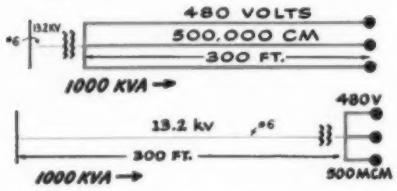
For many months we have been making available to everyone the more significant, the most useful facts pertaining to copper conservation. Witness the several publications shown here, and described further in the following pages.

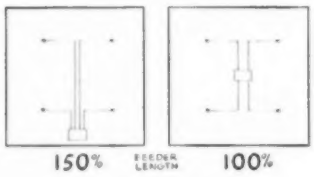
From all these facts, one conclusion stands out clearly. You men in the field—collectively—by making proper application of cable, transformers, motors, control, and other devices, can save even more copper than we can. You can save more in days than a manufacturer can save in months, just by making the right applications. We urge you to study the facts and lend your best judgment to the highly important job of conserving this most precious metal. *General Electric, Schenectady, N. Y.*

The Army-Navy "E", for Excellence in the manufacture of war equipment, now flies over six G-E plants employing 100,000 men and women.

GENERAL ELECTRIC

FOR NEW PLANTS OR PLANT EXTENSIONS, REMEMBER THESE SIMPLE COPPER-SAVING RULES





To carry 150 kva — 3 phase —

At 208 volts, requires this size copper conductor

At 240 volts, requires this size copper conductor

At 480 volts, requires this size copper conductor

A detailed explanation of these principles is available in our recent publication, "5 Ways to Conserve Copper." Ask for GED-1011.

1. Cover as much distance as possible with high-voltage circuits. Keep the low-voltage (heavy copper) circuits as short as possible.

2. Locate substations in the centers of load areas. Modern safety-enclosed unit substations make this practicable.

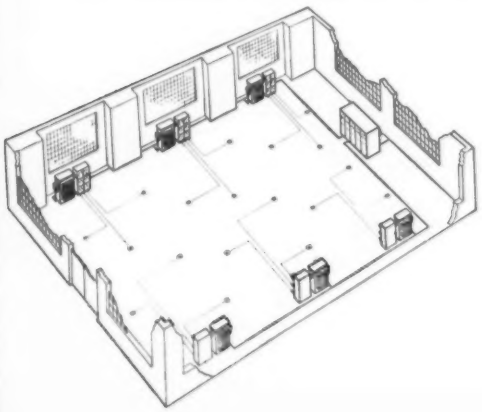
3. Use small-size substations. You save copper that way; but they must not be too small or your use of materials won't be economical. The optimum substation ratings for 480-volt secondaries are 750 and 1000 kva; and for 208/120-volt or 240-volt secondaries, 300 and 500 kva.

4. Distribute power at the highest practical voltage. For example, choose 440 volts for your integral-horsepower-motor circuits in place of 220 volts.

5. Use cable with high-temperature insulation to carry more current—varnished cambric instead of code rubber.

IF YOU SUBSCRIBE TO THESE PRINCIPLES YOU'LL WANT A COPY OF THIS BOOKLET...

GED-1006



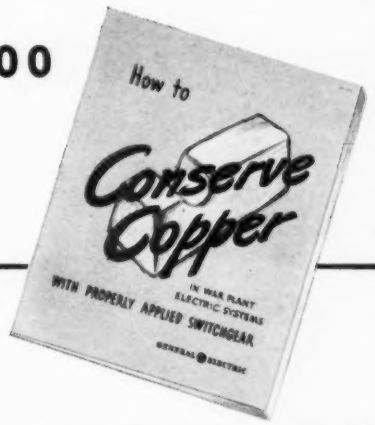
One of the important developments in electric power systems since the war began is the load-center method of distributing power in industrial plants. This is based on the use of compact, factory-assembled, load-center unit substations, as shown in the illustration at the left.

Power is distributed at relatively high voltage (2.4 to 13.2 kv) within the plant to load-center unit substations located near the centers of electrical load areas. There it is stepped down to utilization voltage (below 600 volts) and distributed to the load through drawout air circuit breakers and *short* secondary feeders. By keeping the heavy secondary feeders to the minimum length, considerably less copper is required, and the performance of motors, lamps, etc., is materially improved by the resultant reduction in voltage drop.

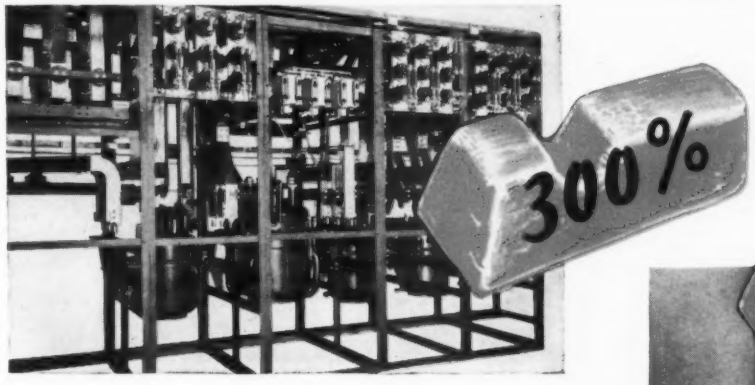
GENERAL ELECTRIC

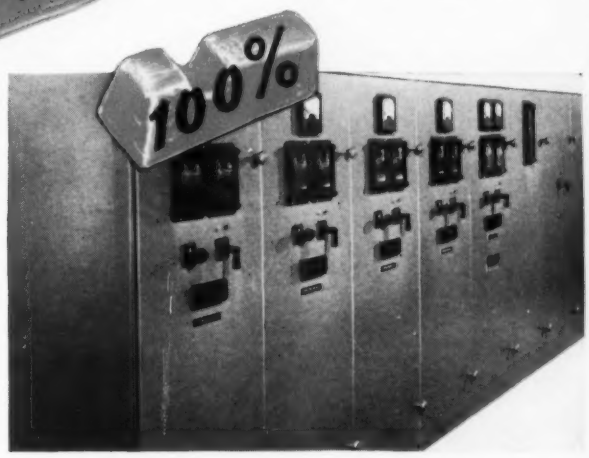
THE RIGHT KIND OF SWITCHGEAR, TOO MEANS COPPER SAVED

—AT LEAST 60%, ON MOST JOBS



Write for Bulletin GES-3031, on how to save copper through properly applied switchgear.



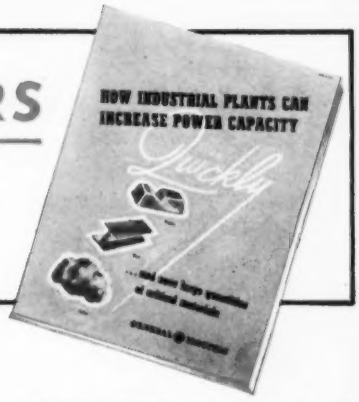


Open-type switchgear—with many strung-out copper interconnections mounted on a bulky, structural-steel framework—calls for a lavish use of copper.

Safety-enclosed switchgear is compact, and its copper interconnections are short. What's more, it completely eliminates the copper disconnecting switches seen in the open-type assembly (above), because modern vertical-lift breakers can be quickly and easily connected and disconnected from the main buses. These and other savings regularly cut switchgear copper requirements to less than *one third*.

CAPACITORS ARE GREAT COPPER SAVERS

They provide increased power capacity without adding new generators, transformers, or feeders.



1 INSTALLATION OF FOUR NEW CIRCUITS

	Critical Materials Required (pounds)			
	Copper	Steel	Others	Total
3 New 250-kva single-phase transformers	1525	8100	---	9625
4 New feeder circuit breakers	562	1800	512	2874
Cable for 4 new feeders	4940	---	1230	6170
	7027	9900	1742	18669

2 INSTALLATION OF CAPACITORS

	Critical Materials Required (pounds)			
	Copper	Steel	Others	Total
15 capacitors—90 kva each (One capacitor installed at each load center)	360	2370	2145	4875
SAVINGS IN CRITICAL MATERIALS	6667	7530	-403	13794

Consider a typical industrial plant 400 ft by 750 ft, which has a peak load of 3000 kva, served by 15 circuits, each carrying 200 kva. Because of a large amount of inductive equipment (motors, welders, etc.), the power factor of the circuit is only 75 per cent.

To meet demands for increased production, 718 kva of new power-system capacity must be supplied. You can install four new circuits of 200 kva each. Or you can install capacitors on each of the present circuits. The tables at the left compare the two methods. See how 13,794 pounds of critical materials (6667 lb copper) can be conserved. Incidentally, the capacitor method costs about half as much as the installation of new circuits.

How Industrial Plants Can Increase Power Capacity Quickly—and save large quantities of critical materials—is the subject of a new booklet (GES-3039) now available through your local G-E office.

GENERAL ELECTRIC

YOU MAY BE ABLE TO SAVE 25% IN *CRITICAL MATERIALS* BY MODIFYING YOUR PEACETIME MOTOR POLICY

The new G-E MOTOR FITNESS MANUAL tells what to do to get the most out of motors, old and new. If you are undertaking new work on motor-equipped machines, if you are "switching" motors from one job to another, or equipping machines with new motors, you'll find this bookful of helpful motor facts will save you valuable time. Included with it is another new publication—"How to Save Critical War Materials." This contains the latest WPB recommendations for the selection of motors, and other useful data. Write today for your "MOTOR FITNESS MANUAL, GED-1017."

MOTORS NEEDLESSLY LARGE FOR THE JOB—plus the oversize distribution circuits they require—may be 25 per cent or more on the side of the enemy! That's the percentage of copper and other scarce materials frequently wasted by overcautious motor specifications—by buying the "next larger size" than a machine actually needs.

The extra amount of critical material used in the oversize motor itself is only part of the loss. Operating a motor continuously below its rated capacity can mean wasted copper all the way back to the power plant. Therefore, even your present motors should be so applied as to avoid "overmotoring," wherever possible.

Why not check with your engineers to see if your peacetime motor policy can be modified in the cause of conservation? You'll be helping to make more metals available where they're needed most to win the war.

This new load calculator—the G-E MOTORULE—makes it easy to select motors that match the job when the recommendations of the machine builder are not available. It helps avoid the risk of undermotoring and the waste of overmotoring. With this motorule, you can check to make sure you are getting the most out of all your machine motors, old or new.

Accurate—easy to understand—applicable to the working of a wide range of materials. FREE with full instructions from your G-E Motor Representative or direct from General Electric, Schenectady, N. Y.

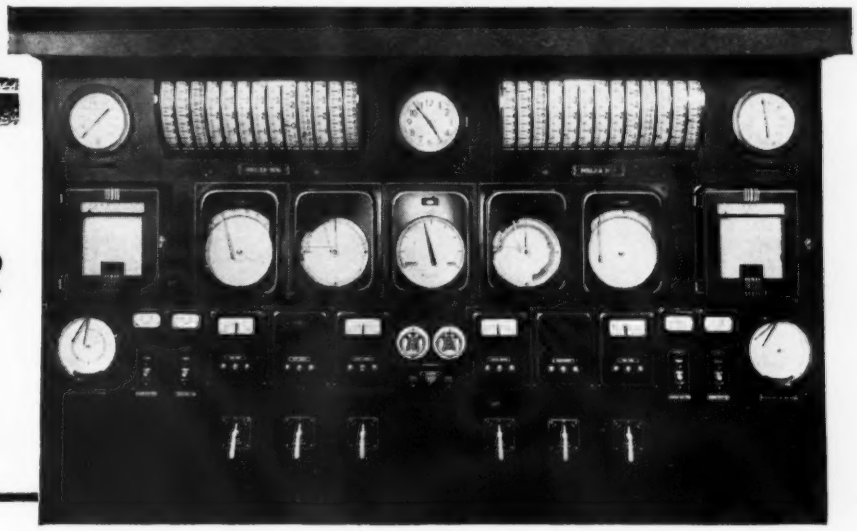
FIND METAL-CUTTING HORSEPOWER *QUICKLY* WITH THE G-E MOTORULE

NEW DEVELOPMENTS IN FLUORESCENT LIGHTING SAVE BOTH *COPPER AND STEEL*

The new G-E Forlamp (265-volt) ballast for war-plant fluorescent lighting operates four 100-watt lamps—twice as many as any ballast previously available. And it's the same size as the Tulamp 100-watt (118-volt) ballast.

This means a saving of 50 per cent in critical materials in plants where voltages within the 250–280 range are available. Furthermore, large savings of copper can be made in the lighting circuit, too, since this ballast operates on circuits of 277/480Y volts. Single-phase circuits of 277 volts require from 60 to 70 per cent less copper than those of 120 volts. Ask for publication GES-3033.

GENERAL ELECTRIC



A REAL *CONTROL CENTER* FOR YOUR POWER PLANT

ALWAYS on the alert to detect signs of combustion trouble and quick to correct it Hays Automatic Combustion Control stands guard over your power plant . . . a real CONTROL CENTER.

It performs *automatically* what a crew of operators would do manually to maintain an even steam pressure under fluctuating demand.

It never gets air-raid jitters, never minds long hours, never gets tired, nor forgets. It's on the job 24 hours a day, seven days a week.

It relieves man power and stretches steam capacity by keeping air and fuel rates in accurately measured proportion to each other and in direct relation to the plant load.

It permits operation of your boilers closer to their maximum capacity with a greater degree of safety and economy than possible under manual operation. It stretches steam capacity.

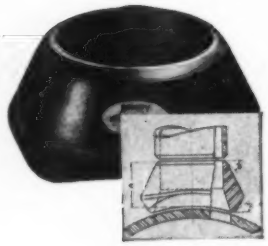
Hays Centralized Automatic Combustion Control is a real CONTROL CENTER for your power plant—vital to all-out war production. Send for latest literature . . . it may be helpful.

THE MODERN SYSTEM *It's Electrical*

HAYS *Automatic* COMBUSTION CONTROL

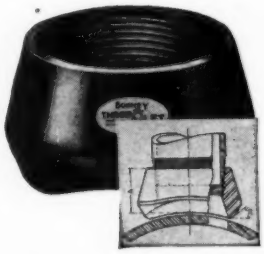
THE HAYS CORPORATION • MICHIGAN CITY, IND.

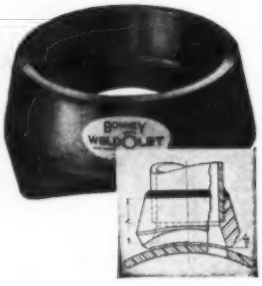
Fittings for all welded right-angle branch pipe outlets



WELDOLETS
for welded branch connections.

THREDOLETS
for threaded branch connections.





SOCKET-END WELDOLETS
for socket-type, welded branch connections.

15 ADVANTAGES

1. Suitable for every piping installation—new construction or maintenance.
2. All templets and preliminary layouts eliminated.
3. Cutting, threading and forming of main line eliminated.
4. Flow conditions improved—turbulence and friction reduced.
5. Installed in 6 easy steps by welder of average experience.
6. Interior of outlet open for inspection after installation.
7. Provide leakproof junctions of full pipe strength.
8. Suitable for all ordinary pressures and temperatures.
9. May be installed before or after erection of main line.
10. Need of braces or supports at junction to care for bending and vibrational stresses eliminated.
11. Reduce cost of branch pipe take-offs.
12. Adapted to pre-fabricated installations.
13. Stock sizes for all pipe up to 12"—on special order to 24".
14. Standard fittings are drop forged steel—wrought iron, Toncan Iron, Monel, Everdur, brass, nickel, etc. on special order.
15. Installed by electric-arc or oxy-acetylene welding.

Bulletin WT31 gives all advantages in detail, complete tables of dimensions and specifications. Write for your copy — TODAY.

BONNEY FORGE & TOOL WORKS,
Forged Fittings Division,
Allentown, Pa.

WELDOLETS·
TRADE MARKS - REG. U.S. PAT. OFF.
THREDOLETS
. . . Welded Outlets for Piping . . .

that of the engineer, this is primarily a textbook for advanced and intermediate students of college physics. Nevertheless, it should be of reference value to those power men whose work lies particularly in the fields of research and testing.

This revision takes account of recent advances of knowledge in the field of extremely low-temperatures, nuclear physics, temperature measurement, etc.

The book is recommended to those who require a fundamental understanding of temperature measurements, kinetic gases, specific heats, relation of x-rays to coefficients of expansion, heat conduction, radiation and similar matters.

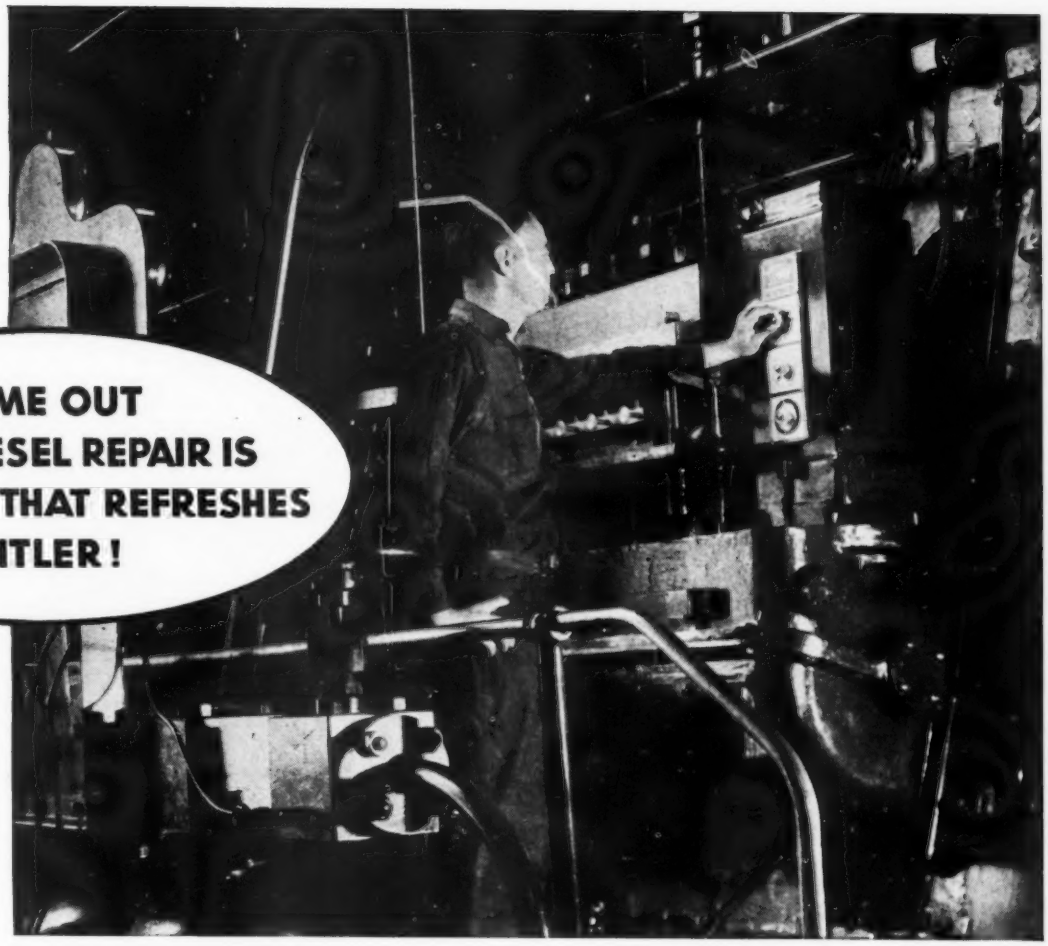
Brief Reviews

23 WAYS TO CONSERVE THE LIFE OF YOUR MULTIPLE V-BELT DRIVES—*Prepared by Engineering Bureau, Multiple V-Belt Drive Assn, 140 S Dearborn St, Chicago, Ill. 16 pages, paper bound, available free on request.* This is not an academic engineering handbook, but rather a primer on the subject of conserving multiple V-Belt drives.

ASSOCIATION OF CONSULTING CHEMISTS AND CHEMICAL ENGINEERS—Classified Directory, 1942-1943 (7th Edition). *Published by the association, and available without charge at 50 E 41st St, New York, N. Y.* As the name implies, this is a directory of consulting chemists and chemical engineers. Includes a membership list, one-page statements from each member descriptive of his and his organization's qualifications, etc, and a record of the work handled by the members, listing the various services performed by them.

ASTM STANDARDS ON COAL AND COKE—*Prepared by Committee D-5, American Society for Testing Materials, 260 S Broad St, Philadelphia, Pa. 122 pages, paper bound, price $1.35 per copy.* This 1942 compilation includes specifications for classification of coals by rank and by grade, requirements for gas and coking coal and specifications for sieves for testing coal.

HYDROELECTRIC POWER — Published by the Allis-Chalmers Mfg Co, Milwaukee, Wis. 28 pages paper bound, profusely illustrated. Available on request. This pamphlet shows pictorially many of the great hydroelectric installations of the world, such as Boulder Dam, Santee Cooper, Pickwick Landing and Chickamauga. Representative industrial and municipal units are also a part of this resume, as well as descriptions of



TIME OUT FOR DIESEL REPAIR IS THE PAUSE THAT REFRESHES HITLER!

WARTIME OPERATION DEMANDS PRECISION LUBRICATION

Sure, breakdowns and delays are headaches to you these days. But, what's worse, they're caviar to Hitler!

All America is depending on you to go all-out for efficient, non-stop operation. And Cities Service can help you do it, these two ways:

1. Cities Service will send a lubrication engineer to study the needs and problems of your particular job. He will work out a lubrication plan to help keep your Diesels running at peak efficiency, to help you prevent breakdowns and costly repairs. In this work he will have at his disposal the Industrial Heat Prover (exclusive with Cities Service), an instrument that eliminates guesswork in analyzing Diesel engine operating problems.

2. Cities Service will supply you with *precision-perfect lubricants*. Cities Service Diesel Oils have been tested under the tough demands of actual day-to-day operation. And they have proved powerful allies in achieving steady, flawless, economical operation of Diesel machinery.

It costs you nothing to consult with a Cities Service engineer, and you are not obligated in any way. Simply call or write the office nearest you.

CITIES SERVICE OIL COMPANY
NEW YORK · CHICAGO

IN THE SOUTH
ARKANSAS FUEL OIL COMPANY
SHREVEPORT, LA.

New DEVELOPMENTS BY FREDERICK ADD NEW THRIFT and CONVENIENCE TO INDUSTRIAL STOKER OPERATION

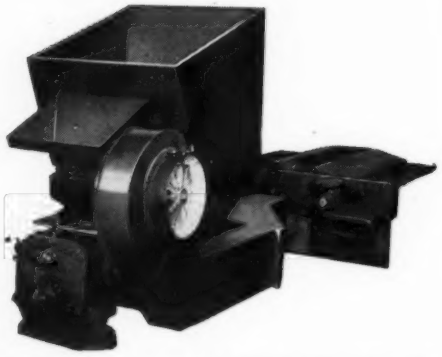
• **FULL ACTIVE GRATE SURFACE . . .** that's one new Frederick advantage! There's more grate area; no dead plates —whether furnished with or without side dumping grates.

• **IMPROVED TUYERES** are designed with air ports so arranged and proportioned as to insure thorough air distribution and maximum combustion efficiency.

• **TUYERES ARE LOCKED IN PLACE** so they cannot be raked up inadvertently.

• **COMPLETELY ENCLOSED WIND-BOX** simplifies and makes a neater installation; eliminates danger of efficiency loss through leaky brickwork.

• **TWO CLEAN-OUT DOORS** give easy access to *both* sides of the undergrate area to facilitate cleaning.



. . . All these features, and many more, are Frederick innovations engineered to give you more for your stoker dollar than has been available ever before. A complete description of these features is in our new Stoker Bulletin. Ask for your free copy. You'll find it's interesting reading.

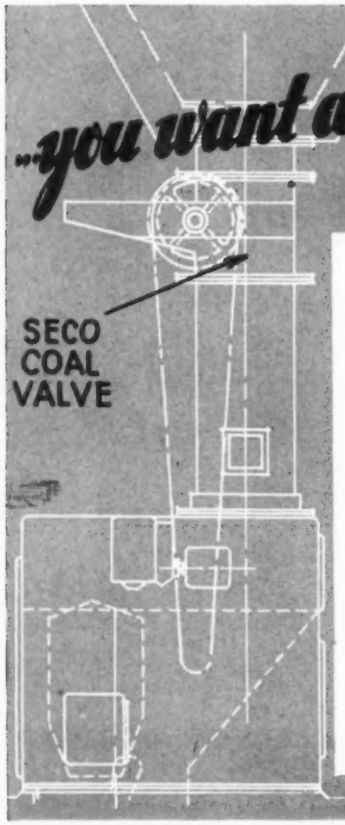
FREDERICK STOKERS

The FREDERICK IRON & STEEL CO.

Frederick, Maryland

COMPLETE LINE OF CENTRIFUGAL PUMPS FOR ALL PURPOSES
STEAM OPERATED ASH CONVEYING SYSTEMS - ASH STORAGE BINS

"...you want a Coal Valve that WON'T STICK"



— here it is — the SECO Coal Valve. A patented U-section gate forms effective protection against coal and moisture for the racks and pinions. Operation of the gate is through two integrally cast racks under the protecting side shoulders, away from the coal. The Gate Rollers are roller-bearing equipped, have grease fittings and metal dust seals, and, like the racks and pinions, are protected from contact with coal by their shielded location. These many features combine to make SECO Coal Valves absolutely dust-tight. A representative product — an important cog in STOCK'S complete "BUNKER-TO-STOKER & BUNKER-TO-PULVERIZER" coal supply systems. Want detailed drawings on this valve, as well as drawings on other SECO products? Write, wire or phone today!

COAL VALVES • COAL SCALES • COAL DISTRIBUTORS • COMPLETE "BUNKER-TO-STOKER AND BUNKER-TO-PULVERIZER" INSTALLATIONS

STOCK ENGINEERING COMPANY

9807 THEODORE AVE. CLEVELAND, OHIO

impulse, Francis and propeller-type turbines.

HANDBOOK OF CARE IN THE INSTALLATION AND USE OF MECHANICAL RUBBER EQUIPMENT—Published by Republic Rubber Div, Lee Rubber and Tire Corp, Youngstown, Ohio. 32 pages, paper bound. Presents a list of essential considerations in the installation and operation of conveyor belting to utilize to the fullest extent the value of rubber used in its construction. Provides essentially the same data for elevator, transmission and V-belting and hose.

Power Lines

(*Continued from page* 128)

the past six years, has been named Southeastern district manager for Wheelco Instrument Co, Chicago. He will make his headquarters at 305 Techwood Drive, Atlanta, Ga.

B DELORENZO has been appointed manager of the heat transfer department of the Brown Fintube Co, Elyria, Ohio. Mr. DeLorenzo joined the Foster Wheeler Corp of New York as laboratory technician in 1932, and since 1936 has been design engineer for Foster Wheeler in the oil division, specializing on heat transfer and flows of fluids.

P W FOSTER, JR, has been elected vice-president of the Foster Wneeler Corp, New York, N. Y., having been with the corporation since its organization, and before that with one of its antecedent companies.

LESTER B HAMMERSLEY has been appointed sales manager of the American Coal Burner Co, Chicago, Ill. Mr Hammersley has been with the company since 1938.

OBITUARIES

NICHOLAS STAHL, 66, a widely known authority on power engineering from 1918 to 1928, general engineer of the Narragansett Electric Co, Providence, R. I., and later chief engineer of the Pennsylvania Power & Light Co, Allentown, Pa., died at the New Haven (Conn.) Hospital on Jan 1, 1943. He was born at New Castle, Pa., educated at Princeton University, and was with the Westinghouse Co prior to entering the utility field. While in Providence

"M" AWARD

for A. P. Green Fire Brick Company

U. S. MARITIME COMMISSION HONORS "OUTSTANDING ACHIEVEMENT" IN WAR PRODUCTION

A. P. GREEN FIRE BRICK COMPANY
Mexico, Missouri

As Chairman of the U. S. Maritime Commission Board of Awards, I take pleasure in advising you that the board, in recognition of your outstanding production achievement, has awarded your plant the Maritime "M" Pennant, the Victory Fleet Flag, and Maritime Labor Merit badges for all your employees.

H. L. VICKERY, Commissioner, U. S. Maritime Commission

★ ★ ★ ★ ★ ★

Official presentation of the United States Maritime Commission "M" Pennant, the Victory Fleet Flag to the A. P. Green Fire Brick Company, and the Maritime Labor Merit Insignias to all its employees was made by Colonel Willard F. Rockwell, Director of Production for the Maritime Commission, during ceremonies at the plant.

This Merit Award—the highest of all United States Maritime Commission honors—is for outstanding achievement in the production of fire brick and refractory materials essential to the shipbuilding program of the Maritime Commission.

A First

The A. P. Green Fire Brick Company has achieved the special honor of being awarded not only the first Maritime "M" in the State of Missouri—but also the first in the entire fireclay industry.

The "M" burgee, a pennant containing the letter M in white on a blue background, with a gold star, is a six-month award from the Commission, signifying Maritime Production Merit.

The Victory Fleet Flag, symbolic of the emergency fleet program, has a blue background on which is displayed the Maritime Victory Eagle in white, surrounded by thirteen gold stars. A red bar across the Eagle's breast carries the words "Ships for Victory."

With the "M" burgee and the Victory Fleet Flag go Labor Merit Insignia to each employee.

These awards are made for meeting all delivery schedules, for cooperation and for generally contributing to the Maritime Commission's shipbuilding program.

Our Part in the Maritime Program

This is a global war. Battlefronts form in almost every part of the world and the success of the United Nation's cause depends upon the transportation of materials to the right place at the right time. This means ships—and the U. S. Maritime Commission is doing the job by turning out a Victory Fleet with speed and proportions beyond anything the world has ever known. No maritime nation in history has ever talked in such figures—no other could possibly approach them.

But these ships are not all built at tide-water. Part of the job is often done far away. The A. P. Green part—in Missouri—hundreds of miles from the sea—is in turning out fire brick and refractory materials to line the boilers of the Liberty Ships. Without fire brick there could be no steam or energy for moving these ships.

And as the cry goes on for ships—and more ships—to carry the materials that will bring victory to the cause of freedom, A. P. Green employees are proud of their contribution to the shipbuilding effort. They are proud of the honor bestowed upon them through this Award of Merit by the Maritime Commission—and promise to carry on with all their might and skill.

A. P. Green REFRACTORY PRODUCTS — SERVE THE WORLD'S INDUSTRY

Fireclay Brick . . . Super Duty Brick . . . High Alumina Brick . . . Special Refractory Tile . . . Insulating Fire Brick . . . Plastic Fire Brick . . . Mortars . . . Maintenance Coating Materials . . . Refractory Castables . . . Oil Burner Combustion Chambers . . . Industrial Insulations

---

A. P. GREEN
FIRE BRICK COMPANY

A Complete Line of High Grade Refractory Products

MEXICO, MISSOURI

Offices: NEW YORK • CHICAGO • DETROIT • ST. LOUIS • TORONTO

AN IMPORTANT ANNOUNCEMENT TO ALL TUBE CLEANER BUYERS

Because it has become impossible for us to meet the ever increasing demand for Wilson Tube Cleaners and Wilson tube cleaning accessories in our plant at 47-28 37th Street, Long Island City, N. Y., we have purchased the building shown in the above photograph.

In our new home we will have available over three and one half times the floor space we had in our former plant. We have installed many new high speed machine tools and the greatly increased production capacity which these additional machines are giving us enable us to make more Wilson Tube Cleaners and accessories and also to make quicker shipments.

Write for the name of our representative nearest to you or ask for a copy of our NEW forty-page catalog which fully describes and illustrates the complete line of Wilson tube cleaning equipment.

INVEST IN AMERICA! BUY WAR BONDS AND STAMPS!

THOMAS C. WILSON, Inc.
PIPE AND TUBE CLEANERS EXCLUSIVELY
THE WILSON BUILDING
21-11 44TH AVE. LONG ISLAND CITY, N. Y.

HI-TEST KEWANEE
POWER, INDUSTRY OR PROCESS STEAM

Cut-away view showing refractory lined firebox

A quick steaming, *All-Welded* portable boiler, economical to handle.

Refractory lined fire-box and two-pass tubes are easy on the fuel bill. 6 sizes, 50 to 150 H.P.

125 and 150-lb. steam working pressure.

For 6" rule with scale for reading pipe sizes, write Dept. 89K-11.

KEWANEE BOILER CORPORATION
KEWANEE, ILLINOIS

Mr Stahl pioneered in the installation of fuel oil at the Narragensett plant.

FRED L HALE, 77, for many years plant engineer of the former Home Sewing Machine Co, Orange, Mass., and one of the earlier recipients of a first-class steam engineer's license in Massachusetts, died in Gardner, Mass., Dec 29, 1942.

J HENRY CONNELL, 66, chief engineer of the municipal pumping station at Swampscott, Mass., died there on Dec 29, 1942.

HARRY E BARBER, 68, for many years a prominent engineer in the heating, ventilating and power plant field in New England, died at Needham, Mass., on Dec 28, 1942.

MABON P ROPER, 50, president of the George D Roper Corp, died recently at his home. At the time of his death Mr Roper was a president and director of the George D Roper Corp and a director of Blackhawk Engineering Co, a Roper subsidiary.

FREDERIC C BLANCHARD, for some time connected with the former Ashcroft Mfg Co, Bridgeport, Conn., and a well-known specialist in the lubrication engineering field, died at Brookline, Mass., on Dec 9, 1942. Mr Blanchard was graduated from the Massachusetts Institute of Technology in 1891.

JOHN H MCKELVEY, vice-president of Laclede-Christy Clay Products Co, St. Louis, Mo., died Wednesday, Dec 16, 1942. Mr McKelvey began working as a telephone boy for the Christy Fire Brick Co, which later merged with the Laclede Fire Brick Co in 1907, to become the present Leclede-Christy Clay Products Co. At the time of this merger he became connected with the sales department. During 1917 Mr McKelvey accepted the position of general sales manager, which position he held until he became vice-president of the company on June 1, 1925. He held this position until the time of his death.

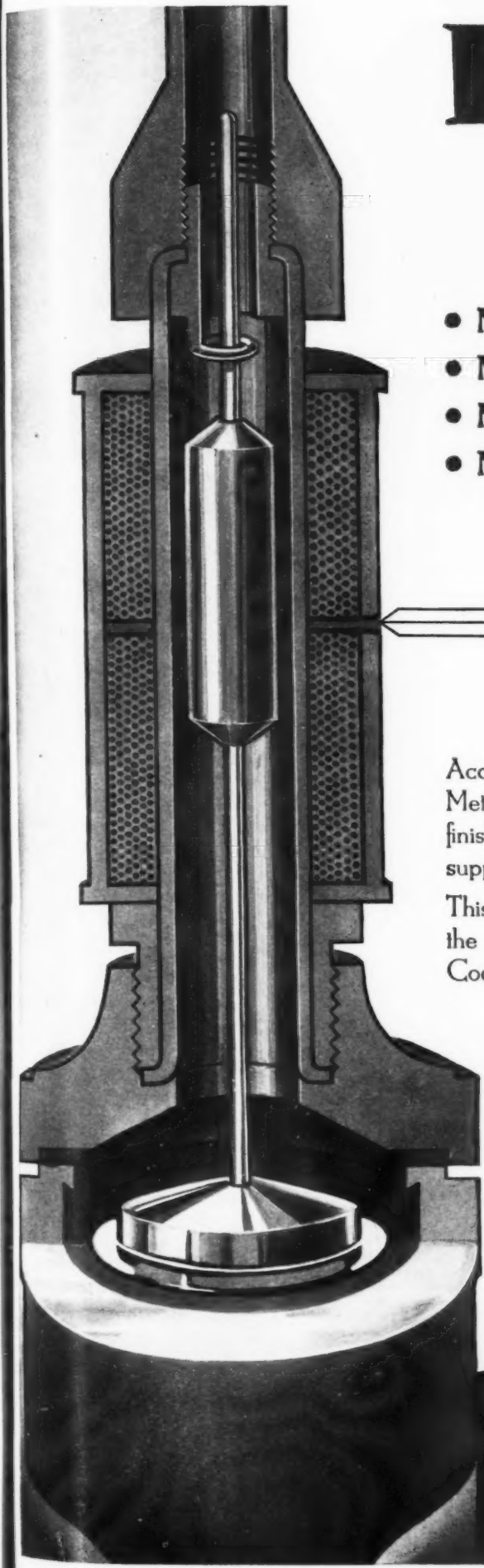
CLIFFORD A NICKLE, consulting engineer at the General Electric Co, died Dec 8, 1942. Mr Nickle entered General Electric's Test Course at the Erie, Pa., works in 1920, and he was transferred to the generator and motor engineering department later on that year. In 1926 Mr Nickle collaborated with Dr R E Doherty on a series of papers presented before the AIEE, which have made history among engineers. The papers, dealing with the performance of

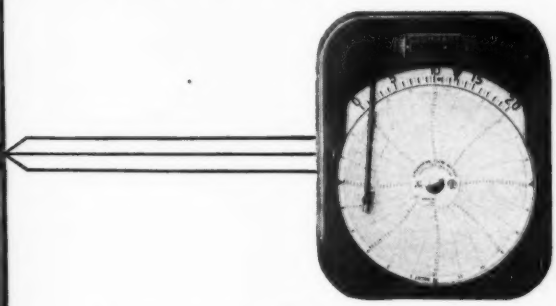
It Floats

...FREELY

$99\frac{44}{100}\%$ Frictionless

- **NO SOLENOID "REACTION"**
- **NO BEARINGS**
- **NO STUFFING BOX**
- **NO ELECTRIC CONTACTS**





Accuracy gets off to a good start in Cochrane Electric Flow Meters because the manometer is practically frictionless. The finish is strong, too, because at the receiver, this null system supplies high and equal power from 0 to 100% at flow.

This power comes from an auxiliary motor and not from the measuring circuit which is relieved of all work. The Cochrane Meter is a true null device.

Remember—

$$\text{Accuracy} = \frac{\text{POWER}}{\text{Friction}}$$

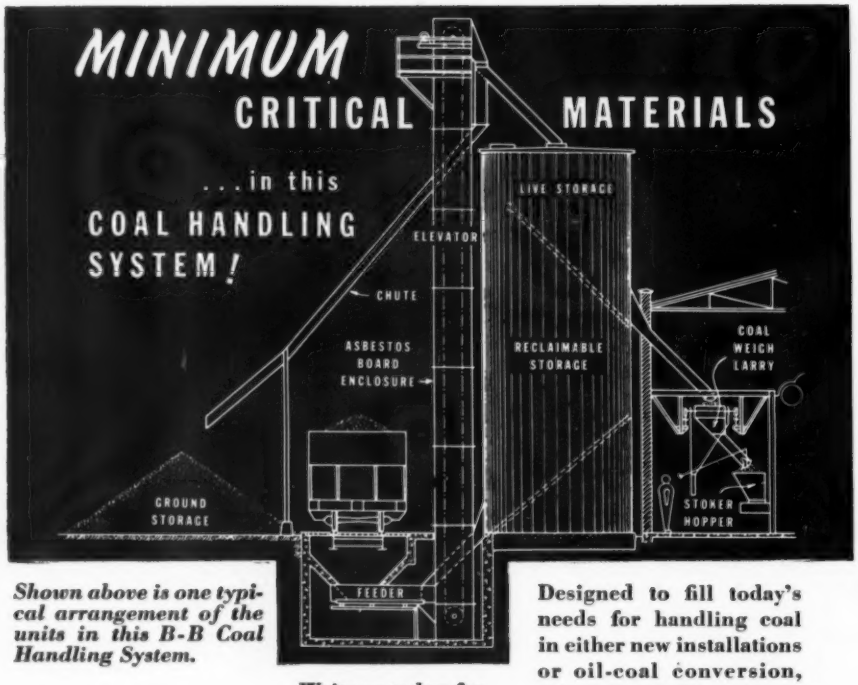
NOTE: A bridge circuit alone is not a null method meter. A galvanometer is required to detect unbalance and an external source of power is needed to restore balance. These are found only in the Cochrane Electric Flow Meter.

COCHRANE CORPORATION
3106 N. 17th St., Philadelphia, Pa.

COCHRANE
FLOW METERS

MINIMUM CRITICAL MATERIALS

. . . in this COAL HANDLING SYSTEM!



Shown above is one typical arrangement of the units in this B-B Coal Handling System.

Write us today for complete details.

Designed to fill today's needs for handling coal in either new installations or oil-coal conversion, this system offers numerous advantages. Send for full information.

BEAUMONT BIRCH COMPANY
1505 RACE STREET PHILADELPHIA, PA.

MANUFACTURERS AND ERECTORS OF COMPLETE COAL AND ASH HANDLING SYSTEMS

SIGN OF PROGRESSIVE ENGINEERING!

J. E. LONERGAN COMPANY ★ Race and Second Sts., Phila., Pa.

SAFETY & RELIEF VALVES ★ PRESSURE & VACUUM GAUGES ★ SPECIALTIES

synchronous machines, have since served to guide in the development of the largest power systems throughout the world.

WILLIAM F COLE, 83, vice-president of the Baldwin-Duckworth Chain Corp, Worcester, Mass., until his retirement a few years ago, and for many years widely known in the elevator manufacturing field in that city, died at his home in Worcester on Dec 20, 1942. He joined the Baldwin Chain organization in 1911, becoming vice-president three years later.

JOHN C DAVENPORT, for many years engineer in charge of all electrical equipment contracts at the Allis-Chalmers Mfg Co, died Dec 19, 1942, in Milwaukee. Mr Davenport came to Allis-Chalmers immediately after completing his college training in 1904. Except for a few years at the Allis-Chalmers Norwood, Ohio, plant, he had been at the main plant in Milwaukee since 1904. During this time he was interested in the design of electrical machinery, chiefly large power transformers.

BUSINESS ITEMS

WILSON & BENNETT MFG CO, Chicago, Ill., a subsidiary of the Inland Steel Tool Co, announces that effective Jan 1, 1943, the company name will be changed to Inland Steel Container Co. For several years the company has been operated as a subsidiary of the Inland Steel Co under the management of H Denbigh Ellis, president.

BUDA CO announces the appointment of R C Wietersen, director of purchases for the company. He will be in complete charge of purchases of equipment and material for company products.

Say—You're Cold

Present fuel ration in Switzerland (coal) for household heating has been established at 15% of normal consumption for each household. This even with exploitation of peat bogs in the Jura mountains. (*Swiss Industry and Trade*).

The employees of the GREEN FUEL ECONOMIZER CO celebrated on Dec 17, 1942, the 50th anniversary of the establishment of the company's shop at Beacon, N. Y. The company acquired its first property on May 1, 1892, in the brick building at the corner of Main and Herbert Streets, in Beacon, N. Y. The first cupola of iron was tapped in

OUR biggest job comes after victory. Now we are all doing our utmost to produce for victory. All our thoughts and our efforts are concentrated toward that end. That's as it should be, but there is a much bigger job ahead and it fits in perfectly with our present program. When the war is over and victory is won, when the boys who today want ships, planes, tanks, bombs—and all the other implements and necessities of war; when those same boys want "jobs"—with honor—let's be ready. Let's be ready to help rehabilitate them, so that they can maintain their self-respect and dignity—no created jobs—but honest work, good wages and an opportunity to live the lives they planned yesterday. Let's keep expanding our facilities—improving our methods, and be ready to do our full share in a bigger, better program; the rebuilding of the world.

Pittsburgh Piping & Equipment Co.

10 FORTY-THIRD STREET PITTSBURGH, PA.

Woolworth Bldg., New York
Public Sq. Bldg., Cleveland
Occidental Bldg., Indianapolis
10 High St., Boston
Peoples Gas Bldg., Chicago
Union Guardian Bldg., Detroit
525 Market St., San Francisco

Sample Coal the "STURTEVANT WAY"... and cut out guesswork in your biggest expenditure

Coal is probably your largest single item of expense. You undoubtedly check its weight and O.K. bills for it, but how do you sample it to determine its actual B.T.U. value? What's the use in spending a lot of money for laboratory service if the coal samples submitted for analysis are not represented?

Sampling with the IMPROVED STURTEVANT AUTOMATIC COAL CRUSHER AND SAMPLER eliminates the notoriously hit-and-miss inaccurate results common to hand sampling. Instead, it provides a continuous system of sampling and crushing and makes samples available that are truly representative and accurate—an important advantage to consider today when plant efficiency must be maintained in spite of having to use coals, the quality of which varies considerably with each delivery into your bunkers. To know your B.T.U.'s exactly *at all times* is to be able to adjust your plant to attain best possible performance without danger of interrupted service. Economy, too, in the use of coal depends on knowing exactly what's in every ton of coal you buy. Get the most out of your biggest expenditure by sampling your coal the "STURTEVANT WAY."

because

- **guesswork is eliminated**
- **absolute accuracy is assured**
- **results are truly representative**
- **sampling is simpler, faster, automatic and not dependent on the human element**
- **32 out of 34 operations involved in hand sampling are eliminated.**

OPERATION AND CAPACITY

The STURTEVANT AUTOMATIC COAL CRUSHER AND SAMPLER reduces 3"coal samples to 8 mesh or finer at the rate of 1 ton per hour and at the same time automatically extracts an accurate, truly representative 5, 10 or 15% (as desired) sample of the whole, ready for laboratory analysis. The machine is available with belt or motor drive, requires 3 H.P. for operation and requires a floor space of only 3' 0" x 2' 0".

Write at once for Bulletin No. 85 "How to Sample Coal Automatically."

Sturtevant Mill Co.

103 Clayton St., Dorchester, Boston, Mass.

October of that same year. Prior to that the economizers were manufactured in Wakefield, England, as early as 1845. The first order of the American branch was dated about 1870, and was shipped from abroad.

DETROIT REX PRODUCTS CO have moved their Los Angeles office to new and larger quarters at 1506 Santa Fe Avenue. S B Crooks, transferred from the midwestern region with offices in Chicago, becomes manager of the Pacific region, with headquarters in the Los Angeles office.

The first American Red Cross First-Aid Detachment to be organized in an industrial plant under the auspices of the Passaic, N. J., Chapter has been formed at the plant of the MANHATTAN RUBBER MFG DIVISION OF RAYBESTOS-MANHATTAN, INC. The Passaic Chapter has supervision over Red Cross activities in the busy industrial communities of Passaic, Garfield, and Wallington, all in New Jersey.

THERMIX ENGINEERING CO has moved its offices from the Smith Building to the First National Bank Building in Greenwich, Conn. This firm is the sales and engineering representative for Thermix dust collectors, stacks and recirculators and Heacon dampers.

POWER MACHINERY CO has been appointed sales representatives, in Oklahoma and western Arkansas, of the Blackmer Pump Co, Grand Rapids, Mich. Egon Koehler is president of the representative company.

WESTINGHOUSE ELECTRIC & MFG CO announces several personnel changes: Walter M Dick, treasurer of the Westinghouse Electric Supply Co, retired Dec 31, 1942, after forty years of service. Clinton R Hanna, a Westinghouse research engineer for twenty years, recently received directly from President Roosevelt a citation of individual production merit for his work in developing a device that increased the effectiveness of American tanks. Percy E Rhicard, works tool engineer at the East Springfield plant of the company, recently received the company's highest award for his work in designing tools for the production of ordnance equipment. Presentation of the award, the Westinghouse Order of Merit, was made on Dec. 12, 1942, by J H Ashbaugh, manager of the company's electric appliance division at Springfield. Samuel W. Chantler, superintendent, and Percy N Love, industrial relations supervisor, of the Canton Ohio division of

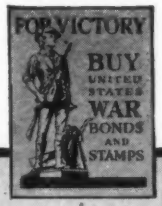
WOULD *You* HALF-RATION OUR FIGHTERS?

This pile, big as it is, contains *only half enough* scrap to run Youngstown's open hearth furnaces *one day.*

Imagine a pile 20 times this big and you know how much scrap it takes each 12-hour turn to keep all the steel mills going.

Each time this pile goes, another must be ready to take its place—twice a day, every day, until the war is won.

It's the dormant scrap you make available that will keep the nation's scrap pile up. If you slow down or stop your effort to find it and turn it in—if the mills have to do with one pile a day instead of two—then YOU must share the hazard of putting the boys in uniform on half-rations of steel!



THE YOUNGSTOWN SHEET AND TUBE COMPANY

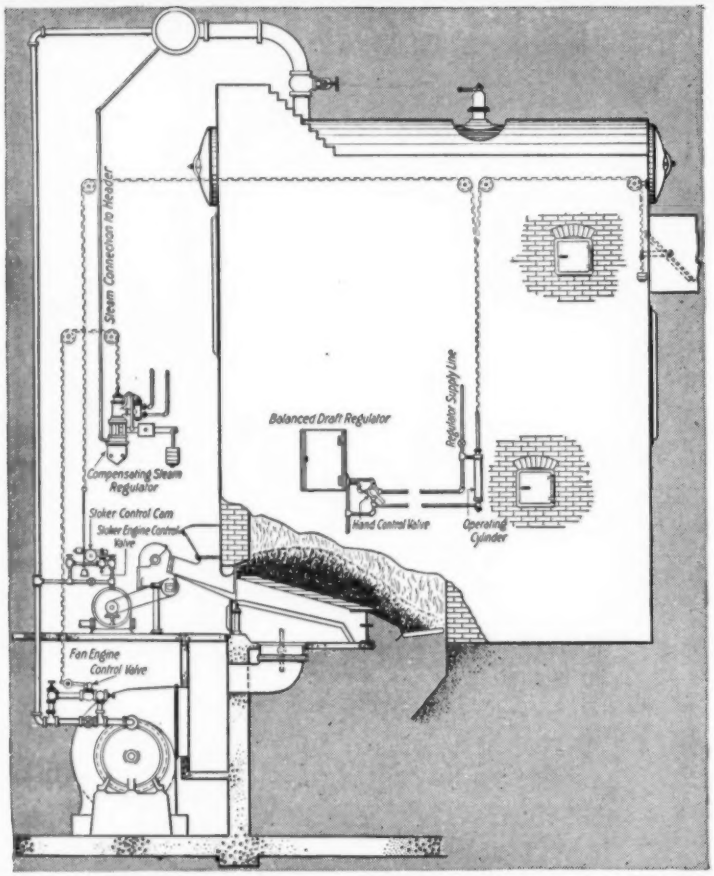
Youngstown, Ohio

25-44E

THROW YOUR SCRAP INTO THE FIGHT — YOUNGSTOWN — TRADE MARK

If you are changing to coal... get the most from it with...

Enco Balanced Draft



A PRACTICAL SYSTEM THAT AUTOMATICALLY CONTROLS

. . . FURNACE PRESSURE, STEAM PRESSURE, FANS AND STOKERS

You can get all the advantages of balanced draft with the Enco system which conforms to accepted practices of combustion control and yet is simple and easy to install and maintain.

It is adaptable to all methods of coal firing . . . stokers of the underfeed, overfeed, spreader or traveling grate types, as well as hand-firing.

The apparatus is so free of complications and delicate mechanisms that it can be installed by your own maintenance crew and kept in operation with the greatest ease.

It may be either hydraulically or pneumatically actuated.

Ask for bulletin B.D. 43 on "Combustion Control" and get the facts on this practical, low cost system that has been in use for over 25 years on more than 1000 boilers.

THE ENGINEER COMPANY
75 WEST STREET (Enco) NEW YORK, N.Y.

the company, have been awarded the Westinghouse Order of Merit for their achievements in speeding war production. John Rosevear, veteran engineer of twenty years' service, has been appointed staff assistant in the industrial engineering and equipment department of the company's lamp division at Bloomfield, N. J. In his new position, Mr Rosevear will help coordinate activities of this recently reorganized department which deals with problems of tooling and the development of new manufacturing processes.

THE GENERAL ELECTRIC CO announces that J W Belanger has been named manager of the company's Federal & Marine Dept. In his new capacity, Mr Belanger succeeds D W Niven, manager since 1921, who will continue as a member of the department available for consultation and special duties. The company also announces that J Edwin Doyle has been appointed assistant to the manager in charge of labor relations at the Lynn River Works. Mr Doyle has been with the company since 1916, when he joined the transformer department of the Lynn River Works.

CURRENT ARMY E NAVY AWARDS

Dow Chemical Co. "Double" Award presented recently.

The Fulton Sylphon Co. Award with added star for sustained high achievement presented recently.

Hercules Motor Corp. Award presented Jan 11, 1943.

Buffalo Forge Co. Award presented December, 1942.

American Locomotive Co, Dunkirk plant. Maritime "M" Award presented Dec 18, 1942.

Monsanto Chemical Co. Joint award presented to St Louis plant, Chemical Warfare Service, and St Louis plant No. 1.

Westinghouse Electric Elevator Co. Two-starred award presented Nov 23, 1942.

Cooper-Bessemer Co. Maritime "M" Award presented Dec 19, 1942.

Warren Webster & Co. Award presented Jan 5, 1943.

American Optical Co. Award presented Southbridge plant recently.

St Marys Mfg Co. Award presented Jan 6, 1943.

IN THIS WAR, rubber is literally a matter of life and death—not only on the battle front—but on the production front in the hundreds of factories—where Multiple V-Belt Drives are turning the wheels of thousands and thousands of machine tools.

And that makes the need for utmost conservation of V-Belts, so vital to Victory, a two-fold MUST! Machines must run at peak efficiency with down time cut to an irreducible minimum. And, waste must be eliminated to provide precious rubber for life rafts and scores of other military needs.

As a contribution to the war effort the Multiple V-Belt Drive Association has prepared a book of information on this important subject. It is FREE for the asking. If you are a power user, write for your copy today—and help win the war by conserving your V-Belt Drives.

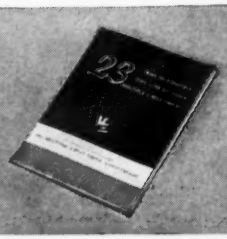
TRADE MARK

The use of this emblem by an association member in connection with Multiple V-Belt Drives is your assurance of mechanical excellence... the result of cooperative engineering, research and experience.

MULTIPLE V-BELT DRIVE ASSOCIATION

140 SOUTH DEARBORN ST., CHICAGO

Write for this FREE Association Book Today!



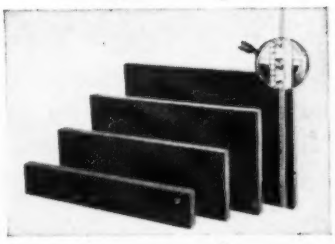
IF YOU SPECIFY INSULATION ACCORDING TO ITS RESISTANCE TO HEAT AND STABILITY (ROCK-WOOL'S 2 GREAT ENEMIES) THEN YOU WILL SPECIFY B-H BLACK ROCK-WOOL INSULATIONS

1400° of open flame eats right through white rock wools, but does not faze B-H black rock-wool. Moisture soaks into white rock wool and starts its disintegration, but B-H black rock-wool remains unaffected in any way.

B-H

FREE TO POWER-PLANT MEN

A generous sample square of Baldwin-Hill Mono-Block, the one block for all temperatures up to 1600°, together with a sample of B-H Bond-Tite, the easy adhesive which makes wiring unnecessary. Test for yourself the heat-resistance, the extraordinarily low conductivity, the quick adhesion, and ease of cutting of this universal insulation. Just write us on your letterhead.



BALDWIN-HILL *Insulations*

575 KLAGG AVE. NEW YORK — CHICAGO — TRENTON, N. J. KALAMAZOO

H M Harper Co. Award presented Dec 7, 1942.

The National Supply Co. Maritime "M" Award presented Dec 17, 1942.

Raybestos-Manhattan, Inc. Award presented "Garco" plant, Nov 28, 1942.

Announce Salvage Division of WPB

War Production Board Chairman Donald M Nelson announced recently the formation of a Salvage Division, headed by Paul C Cabot as Director.

Creation of a Salvage Division follows the resignation of Lessing J Rosenwald as Director of the Conservation Division of which Salvage formerly was a Branch. Mr Cabot was Deputy Director of the Conservation Division in charge of all salvage operations. The new division will be in the Resources Agencies group under the Director General for Operations.

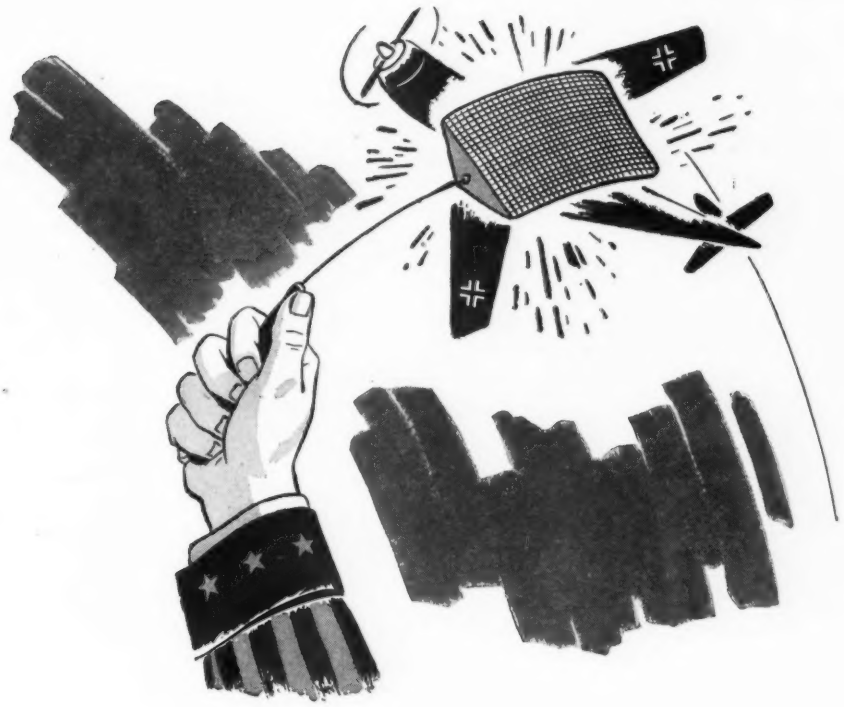
"Setting up Salvage as a separate Division of the War Production Board is a recognition of the importance this work has played and must continue to play in the war effort," Mr Nelson stated.

"When government salvage operations were first started about a year ago as a branch of the Conservation Division the nation faced a critical situation in shortages of iron and steel, fats and greases, waste paper and other salvage items. At that time 45 steel furnaces were down because of lack of iron and steel scrap. The job of stimulating and intensifying public interest in the collection of iron and steel scrap to start these furnaces operating again fell to the Salvage Branch which was greatly aided in its efforts by many groups and civic organizations throughout the country."

Today all these furnaces are back again in full operation and none have been shut down because of any lack of iron and steel scrap since last summer. The recent salvage drive conducted by the American Newspaper Publishers Association Salvage Committee has been declared outstandingly helpful to the thousands of volunteer salvage committees in improving the current iron and steel scrap situation.

Collection programs for other vital salvage items such as, copper, silk stockings, tin cans, farm scrap, heavy scrap and rubber have been conducted through the year by the Salvage Branch of the Conservation Division.

"Although current inventories of iron and steel scrap are much improved over a year ago and other salvage conditions are in better shape, it is ex-



CLEAN AIR Helps *SWAT 'EM* on the Ceiling

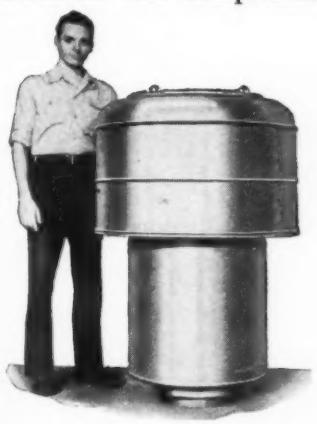
Where it doesn't matter, you and I can take our air as we find it. But the men who build guns must be more particular.

In more than one ordnance forging plant, tons of compressed air—cleaned by Air-Maze—help put American shells on Axis targets.

Clean air lets compressors, engines and other machines run longer without trouble. Thousands of Air-Maze filters have been selected for these jobs because they are dependable, efficient and permanent.

From filters nearly as tall as a man, to units that fit in your hand, Air-Maze is equipped by nearly 20 years' experience to solve any problem of air filtration.

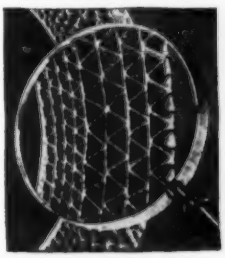
More than 3,000 types and sizes of Air-Maze filters are available. They include filter-silencers, oil-bath and viscous-coated, cylindrical and panel filters. *Write for complete information on any type in which you are interested.*



◄ AIR-MAZE FILTER-SILENCER
One of over 3,000 Types

Element is viscous-coated, round-wire mesh, scientifically crimped. It is washable, and will not pack down nor separate. Traps over 99% of all practical dust, yet restriction is extremely low.

AIR-MAZE Principle Is More Effective 3 Ways



Cross section, one of many filter media designs

HIGHEST PERFORMANCE is obtained by the unique crimped screen wire media. There are no dead areas. Efficiency actually increases as the wires become streamlined with collected material.

LARGE CAPACITY results from the fact that every inch of wire is available for holding dust.

COMPLETE CLEANABILITY is assured by the uniform "channels" through which dirt is easily flushed out. No possibility of progressive clogging.

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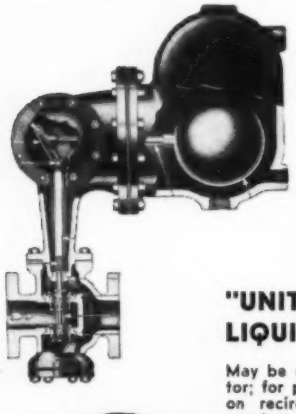
SPECIALISTS IN AIR FILTRATION

K & M
LIQUID LEVEL CONTROLS since 1879

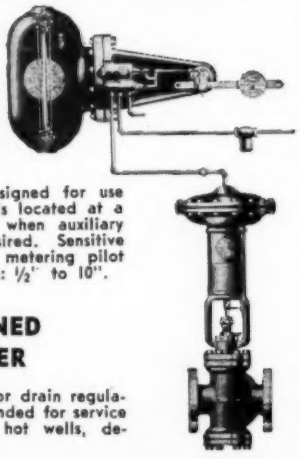
We're "ALL OUT" so the AXIS will be "ALL IN" Please bear with us for the duration —

Kieley & Mueller has been manufacturing precision controls for 63 years. This long specialized experience is behind K&M Liquid Level Controls which are designed to meet the most exacting requirements of present day service. The units shown here are typical of those included in the complete K&M line.



"REMOTROL" PILOT OPERATED LIQUID LEVEL CONTROLLER

A precision pilot control designed for use on applications where valve is located at a distance from float cage or when auxiliary controlled main valve is desired. Sensitive operation assured by special metering pilot and pilot linkage. Valve sizes: ½" to 10".



"UNITROL" SELF-CONTAINED LIQUID LEVEL CONTROLLER

May be used either as a feed regulator or drain regulator; for pressures up to 250 lb. Recommended for service on recirculating systems of condenser hot wells, deaerators, etc. Valve ½" to 4".

KIELEY SINCE 1879 MUELLER

KIELEY & MUELLER

General Offices and Factory

2013-2033 — 43rd Street, North Bergen, N. J.

Reducing Valves — Liquid Level Controls — Float Valves — Pump Governors — Strainers — Control Specialties.

Protect against spalling and cracking

by ARMOR PLATING REFRACTORY LININGS with

BRICKSEAL

By forming a highly glazed semi-plastic surface over refractories, BRICKSEAL seals pores, completely stops infiltration of gases and carbon and minimizes the cause of spalling and cracking.

BRICKSEAL is a combination of high fusion clays and metals combined in oils. It is unaffected by gases, acids or alkalis and is guaranteed not to crack, peel or blister under a wide range of temperatures.

EASILY APPLIED TO ANY SURFACE

Any refractory surface may be "armor plated" with BRICKSEAL which can be applied by air-spray gun or by hand brush quickly and easily. A proper BRICKSEAL application stands up effectively from one to four years. Ideal for new construction or maintenance requirements. Tried and proved in every type of boiler under all conditions.

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—by sending for complete details.

ATTENTION DISTRIBUTORS

Desirable openings are available for sales representation in certain territories. Write for details.

BRICKSEAL REFRACTORY CO.

1029 Clinton St., Hoboken, N. J.

tremely important to realize that scrap needs in the future will be greater than ever," Mr Cabot stated.

"Many situations which were well answered a year ago may again become acute," Mr Cabot said. "Copper needs, for example, have grown enormously over the past twelve months and may require us to go after copper, brass and bronze items, nonessential, but in use today, in the near future to augment the scrap supply that has actively been sought throughout the year. Also, our need for heavy iron and steel scrap such as we get from farms, industry and special projects will be a continuing operation we can never slacken for a single moment.

"So it is highly important," Mr Cabot concluded, "to remember that our salvage duties have only begun and our responsibilities for collecting it are not diminished by what has been done to date. Salvage is a continuing war effort and we expect the people of the country to be working at it for the duration."

Improved Power Factor Adds Power Capacity

Today we must make the most of what we've got, and by cooperatively making the most of available electric power central stations and their industrial customers can assure war production that will lead to victory. In the Westinghouse "Wartime Conservation" it is conservatively estimated that today existing power systems can, by installation of capacitors which reduce power losses, be made to yield 2,000,000 additional kva. It is significant that Germany recognized the need for making

Apologies to Mr Cary-Curr

In Mr Hays article on page 108 of December POWER, the name of Mr Cary-Curr was incorrectly spelled "Carey-Kerr", in accordance with the manuscript received by POWER. The error was called to our attention by Mr Dudley K French, engineering chemist, Winnetka, Ill. After seeing Mr French's letter, Mr Hays wrote as follows:

"I have known Mr Cary-Curr for many years, but never very intimately. I have always felt under great obligations to him for the great help that he gave me when I was trying to put some kind of a real foundation under my instrument business . . . I am sorry for my error, but it was an honest one. I had been under the impression for years that he spelled his name that way. (Signed) Jos W Hays."

How to Get More Life From Worn-out Boilers

If they can pass inspection and a hydrostatic test, APEXIOR will "peg" that condition for more years of good performance.

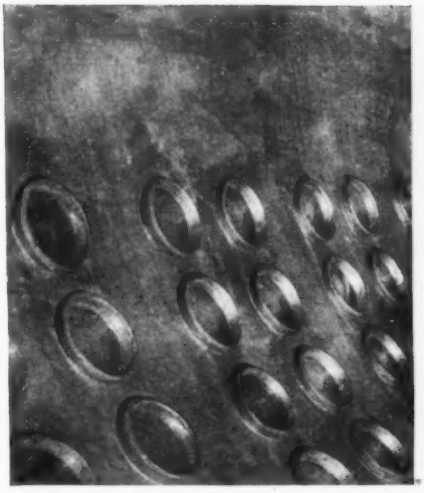
Those boilers nearing the end of their life . . . those boilers already on the inactive list — there's an excellent chance you can get more years of work out of them by APEXIORIZING.

Any boiler that can withstand the required hydrostatic pressure is good for plenty of hard service — if the test strength of the metal is maintained by a durable coating of APEXIOR.

APEXIOR PREVENTS CORROSION FOR 2-3 YEARS

APEXIOR is brush-applied, by hand or power-coater. It fills in the metal pores and joints and forms an impenetrable barrier against water. There is less adherent scale, so scale removal is made easy (with a wire brush) . . . and less often required.

Hundreds of operators have used



APEXIOR for years as an economical means of boiler maintenance. Hundreds more have recently adopted APEXIOR as a guarantee of longer life for metal that cannot be replaced.

An APEXIOR coating will last 2 or 3 years, often longer. It is easily renewed. Save *your* boiler metal from wear and damage that cannot be measured in dollars. APEXIORIZE — and keep boiler metal young.

Easy to Apply — Easy to Maintain — Bulletin 1290 Gives Facts on a Paint that Gives Metal New Life.

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Unique Yarway Involute design.

No internal parts or vanes to clog or erode.

Unobstructed flow gives minimum loss of head.

Finely divided spray cone provides rapid cooling.

Renewable orifices adapt nozzles for any service.

Installations total more than 5 million gallons per minute in water cooling and air conditioning service.

Made in both cast and bar-stock types. All sizes from ¼ in. to 2½ in. Write for Catalog N-616.

YARNALL-WARING COMPANY
100 Mermaid Ave. Philadelphia

the most of what it had early in its war program. Also that Japan, through use of capacitors, gets more power per unit of generating capacity, than any other nation. Great Britain also has used capacitors widely to increase its power supply.

Every utility should immediately investigate how it can increase its output by the use of capacitors. One-third to two-thirds kva of load-carrying capacity is released by each capacitor kva installed. For example, a southern utility recently reduced its load from 92,000 to 83,000 kva, by installing 15,000 kva of capacitor. This made 9,000 kva available for war production. In another case a midwest utility provided 6,000 additional kva of power for a new tank plant by installing 15,000 kva of capacitor.

Every industrial plant should immediately investigate how it can get more production from its present power supply by installing capacitors. A midwestern aircraft parts manufacturer was confronted with the problem of providing more power for his rapidly expanding machine shop. He had to provide system capacity quickly for an additional 600-kw load, with the possibility of more load in the near future. Instead of running another line and adding transformer capacity he installed capacitors which not only made available sufficient capacity for immediate load, but provided additional reserve capacity to handle future loads.

In another war plant the power distribution system was already overloaded at peak conditions when it became necessary to add a 200-kw induction motor load. A survey revealed that 600 kva of capacitors would not only relieve overload, but would carry the additional load. Power factor was improved from 75 to 89.7%, and the load was raised from 1350 to 1550 kw, but kva demand dropped from 1800 to 1730. In this case critical material was saved because extensive rewiring was avoided, and the power company gained a 200-kw pay-load, while 70 kva of its generating capacity was released for other war demands.

Most industrial installations will pay

Boulder Dam's generating capacity was boosted close to the 1,000,000-kw mark recently with installation of an 82,500-kw generator. Total capacity is now more than 950,000 kw.

A similar unit is scheduled to go into operation at the dam early in 1944.

FIVE REASONS WHY YOU SHOULD USE PALMETTO PACKING

1. Lasts longer because it doesn't dry out . . . every strand is impregnated with lubricant before braiding.
2. Doesn't score shafts . . . internal lubricant keeps Palmetto soft.
3. Resists wear . . . made from strong, high grade, long fibre asbestos.
4. Useful in emergencies . . . Palmetto special graphite lubricant resists most fluids.
5. More economical . . . costs less to use in the long run.

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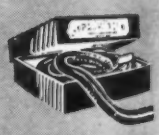
TWISTED
For valve stems; each strand a perfect piece of lubricated packing.

BRAIDED
For rods and shafts; layer over layer construction insures uniformly even bearing surfaces.



PALMETTO
for steam, hot water, air. PALCO for water. PELRO for oils. CUTNO for alkalis. SUPERCUTNO (blue asbestos) for acids. KLERO for foods.

SELF-LUBRICATING PACKINGS

ATTACK

IS THE BEST DEFENSE!

HERE'S HOW TO ATTACK YOUR BATTERY MAINTENANCE PROBLEMS

1. Keep adding approved water at regular intervals. Most local water is safe. Ask us if yours is safe.
2. Keep the top of the battery and battery container clean and dry at all times. This will assure maximum protection of the inner parts.
3. Keep the battery fully charged — but avoid excessive over-charge. A storage battery will last longer when charged at its proper voltage.
4. Record water additions, voltage, and gravity readings. Don't trust your memory. Write down a complete record of your battery's life history. Compare readings.

If you wish more detailed information, or have a special battery problem, don't hesitate to write to Exide. We want you to get the long-life built into every Exide Battery. Ask for booklet Form 2399.

Our strongest defense is a hard attack. That's an old Naval tradition now proving its truth on all the waters of the Seven Seas.

In similar fashion, the best defense against maintenance problems is a relentless, unceasing attack on carelessness and wear. Battery care, for example, is simplified if you observe four basic rules . . . which may be called your rules for attacking battery maintenance problems. Follow them faithfully, and remember, Buy to Last and Save to Win!

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BATTERIES
FOR CRANKING
DIESEL ENGINES

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia
The World's Largest Manufacturers of Storage Batteries for Every Purpose
Exide Batteries of Canada, Limited, Toronto

How to CUT HOLES IN BRASS OR ALUMINUM Quickly

A SMOOTH-ON Speed-Up Tip...

Smooth-On being applied as a thick paste outside of the outer edge of the scribed opening.

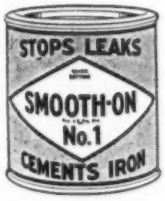
Flame - shaping the desired hole within the limits protected by Smooth-On.

When openings of various sizes are required for branch lines or brass piping or for connections of aluminum vessels, here is an aid to speedier and more accurate work recommended by experienced flame-cutting operators.

Just paint a thick consistency of Smooth-On No. 1 in a band about ¾-in. wide around the outer limits of the scribed opening. The Smooth-On acts as a refractory material to protect the metal which it covers, and helps to prevent melting of the metal beyond the desired limits.

This is but one of literally hundreds of ways in which the various Smooth-On Iron Cements can help you do better, quicker, more economical fabricating, maintenance, and repair jobs on plant equipment, pipe lines and structures.

Get Smooth-On No. 1 in 7-oz., 1-lb. or 5-lb. or 25-lb. containers from your dealer, or if necessary from us. For your protection, insist on SMOOTH-ON, *used by engineers and repair men since 1895.*



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40-PAGE HANDBOOK

Simple, concise instructions for hundreds of material-saving repairs to plant equipment and pipe lines are given in this 40-page practical repair manual. A war-time necessity in every plant. Your copy sent FREE, if you fill in and return the coupon.

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Do it with SMOOTH-ON

for themselves within a year by savings in power bills when power is purchased under a schedule that has a power-factor penalty clause. Let capacitors make the most of the power you have before installing new transformers, switching or wiring.

Weiner Replaces Henderson

Joseph L Weiner, former director of SEC's Public Utilities Division, has been appointed director of the Office of Civilian Supply to replace Leon Henderson, who resigned.

OCS will serve as claimant agency for all civilian allocations of steel, copper and aluminum under the Controlled Materials Plan which becomes official July 1 and under which utilities will obtain their supplies of these metals. WPB's Power Division will be prime contractor for these materials, passing them on to utilities as secondary contractors. In its function as claimant agency, OCS will pass on materials requests made by utilities.

Weiner went to SEC in 1938 as special counsel, after several years with New York's city government, and was named director of its Public Utilities Division before leaving SEC in 1941 to become assistant administrator of the Office of Price Administration and Civilian Supply. Through reorganizations he successively became Deputy Director of the Division of Civilian Supply of the Office of Production Management and deputy director of the Office of Civilian Supply.

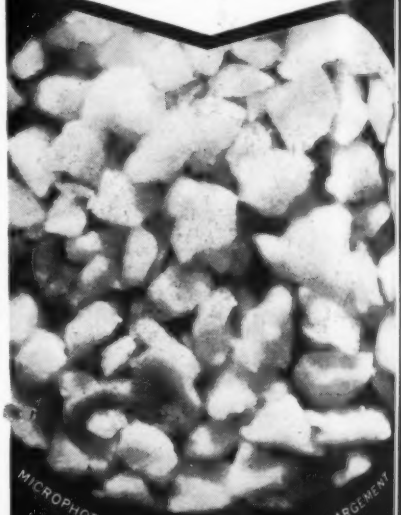
Edison Medal Awarded Edwin Armstrong

The Edison Medal for 1942 has been awarded by the American Institute of Electrical Engineers to Doctor Edwin Howard Armstrong, professor of electrical engineering, Columbia University, "for distinguished contributions to the art of electric communication, notably the regenerative circuit, the superheterodyne, and frequency modulation."

The medal was presented to Dr. Armstrong on Wednesday evening, January 27, 1943, in the Engineering Auditorium, 33 West 39th Street, New York, N. Y., during the National Technical meeting of the American Institute of Electrical Engineers to be held in the Engineering Societies Building, January 25-29, 1943.

The Edison Medal was founded by associates and friends of Thomas A. Edison, and is awarded annually for "meritorious achievement in electrical

OIL MUST PASS THROUGH CRANITE



MICROPHOTOGRAPH SHOWS 75 TIMES ENLARGEMENT OF CRANITE

WHEN IT GOES THROUGH A HONAN-CRANE OIL PURIFIER

★ Cranite, the purifying medium of the Honan-Crane "Continuous" Oil Purifier, is produced by a special processing and blending of Fullers Earths.

This mass of millions of crystal-clean, porous granules each having high adsorbent qualities presents a great surface area that will remove not only tars, gums, resins, carbon and other solid non-lubricants but also acids and soluble sludges, even those which have the same specific gravity and molecular weight as the oil itself.

Cranite presents the maximum in oil purification efficiency and lowest possible cost for complete and satisfactory performance.

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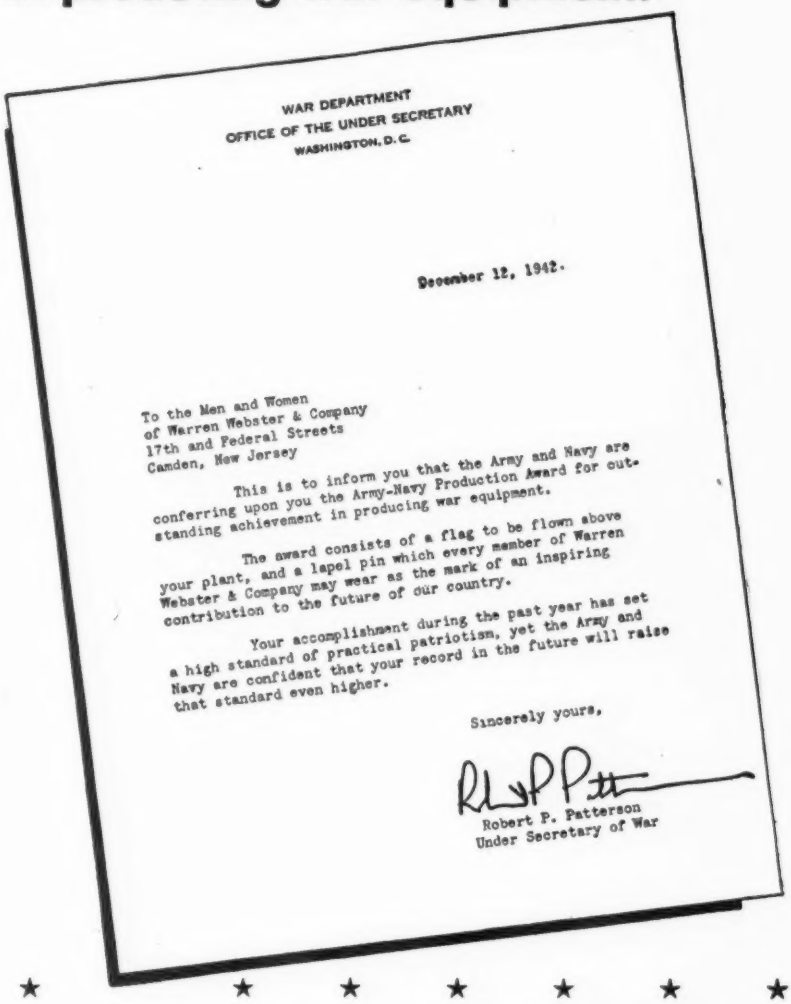
HONORING THE MEN AND WOMEN OF WARREN WEBSTER & COMPANY

". . . for outstanding achievement in producing war equipment."

This badge of honor will be worn proudly by every employee of Warren Webster & Company. It is a daily reminder that their production at high rate and quality is urgently needed for Victory . . . production of Ordnance materials for our fighting men . . . production of Webster Steam Heating Equipment for Army and Navy buildings, war plants, ships and other essential uses.



WAR DEPARTMENT
OFFICE OF THE UNDER SECRETARY
WASHINGTON, D.C.

December 12, 1942.

To the Men and Women
of Warren Webster & Company
17th and Federal Streets
Camden, New Jersey

This is to inform you that the Army and Navy are conferring upon you the Army-Navy Production Award for outstanding achievement in producing war equipment.

The award consists of a flag to be flown above your plant, and a lapel pin which every member of Warren Webster & Company may wear as the mark of an inspiring contribution to the future of our country.

Your accomplishment during the past year has set a high standard of practical patriotism, yet the Army and Navy are confident that your record in the future will raise that standard even higher.

Sincerely yours,

Robert P. Patterson
Under Secretary of War

–since 1888
Webster
Systems of Steam Heating

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Pioneers of the Vacuum System of Steam Heating, Representatives in principal U. S. Cities

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This Book is Yours .. FREE

Combustion Efficiency as applied to Boiler Plant Operation. Fuels and Equipment is now a most important factor in Defense work. Fuels cost more than ever before. Boiler loads are heavier. A scarcity of some kinds of fuel is apparent.

The Combustion trained man — the Hays trained man—can do his part, and open up big opportunities for himself that never existed before, by devoting a little of his spare time in training himself to meet present conditions.

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science, electrical engineering, or the electrical arts" by a committee consisting of twenty-four members of the American Institute of Electrical Engineers.

Dr Armstrong began his engineering studies at Columbia University and became a protege of Michael I Pupin, Edison Medal recipient in 1920, with whom he worked closely on many important research undertakings.

Utility Drives Netted 24,000,000 lb of Scrap

Scrap drives and continuous salvage programs of the electric utility companies in 1942 netted 24,000,000 pounds of copper for the nation's war needs, together with large quantities of aluminum, brass, iron, steel, lead, zinc, rubber and other scarce and urgently needed material, the Edison Electric Institute reported recently in summarizing the results of a survey conducted among utility company members.

The copper turned over to scrap dealers and mills represented approximately ten percent of the normal annual copper requirements of the electric industry, which is the largest user in peace time of the now precious metal. Concurrently with their release of copper to primary military needs, the electric utilities, basic source of power for the war industries, by holding down their own use of copper and other metals to lowest possible levels through substitutions and reprocessing, freed many thousands of tons of new copper and steel for military purposes.

The thoroughness of the scrap collecting job is indicated by the fact that their potential copper salvage for 1943 will be about half the amount gathered in 1942. Nothing was overlooked in gathering scrap for the government, and the list of items scrapped ranged from the metal bases of broken lamps to entire power plants. A striking example of the latter was the dismantling and scrapping of the historic 8-story Edison Station at Philadelphia. Although the building was erected under the personal supervision of Thomas A Edison, and was the city's first successful electric plant and the first building in the United States constructed specifically as a generating plant, the present emergency forced the decision to raze the building.

Included in the collections were such items as old boilers, smoke stacks, motor generating sets, millions of feet of copper wire, steam and pipe valves, old pumps, and watthour meters.

Indicative of the length to which

gain hours

Use Laminum shims to reduce parts machining for easier work tolerances in factory adjustment! More machine hours released for production.

Laminum shims (.003 or .002 inch precision laminations bonded into a solid unit) are cut to your specifications.

Stock shim materials obtainable from mill supply distributors. (Write us for sample and illustrated shim application chart.)

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Incorporated
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it's
LAMINUM
THE SOLID SHIM THAT *peels* FOR ADJUSTMENT

ENGINES LAST LONGER . . . maintenance costs are cut . . . oil is conserved — that's why users of Diesel engines filter their lube and fuel oil with Briggs Clarifiers.

Briggs Clarifiers contain patented Fuller's Earth Blocks — bonded and porous — that draw destructive properties from the oil so that engines are fed "refinery pure" oil at all times.

Regardless of the size or type of your engines, you'll find Fuller's Earth Blocks a vital aid to wartime production.

The blocks prevent accumulation in the oil of sludge-forming resins and gums and engine-corroding acids which otherwise would accumulate and retard engine efficiency and cause unnecessary breakdowns.

Such thorough ADsorption of acids, resins and gums, together with ABsorbing of carbon, grit and dirt, reduces engine wear and saves oil and repair costs.

Write today for recommendation of the type Briggs Clarifier most suitable to your needs.

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A WAR BOND IS A SHARE IN VICTORY

SAVE FUEL
BY REDUCING BOILER SCALE

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TAYLOR
BOILER WATER COMPARATOR

Prevent scale in your boiler . . . increase heat transfer . . . get maximum heat with least fuel . . . by controlling the pH and phosphate content of your boiler water.

With a Taylor Boiler Water Comparator, you may check these important factors accurately and easily in 2 to 3 minutes. The Comparator is extremely easy to use . . . works on the slide principle. The liquid color standards carry AN UNLIMITED GUARANTEE AGAINST FADING. Slide and base are molded from durable plastic. Cost of the complete outfit is very low . . . only $50.00 f.o.b. Baltimore. Just the elimination of one descaling job will pay for it many times over.

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REFERENCE HANDBOOK

Power men all over the country comment enthusiastically about this fact-packed, 80-page booklet. If you want a copy, just drop a letter to Taylor. It's yours . . . without obligation!

W. A. TAYLOR AND CO.
YORK & ROGERS FORGE RDS. • BALTO, MD.

utility organizations have gone in substitutions and conservation is the report from one company that the use of over 20 tons of steel a year is being saved by construction from salvaged fir crossarms of certain items of line hardware normally made of metal.

Welding Award and Scholarship Program

POWER publishes the following letter, from the James F Lincoln Arc Welding Foundation, to clear up any misunderstandings concerning the $6750 Annual Engineering Undergraduate Award and Scholarship Program:

The response from the colleges to our announcement of the $6750 Annual Engineering Undergraduate Award and Scholarship Program has been cooperative and commendatory. There are, however, a few responses which indicate that in certain instances it is assumed that student contestants must have had some previous connection with welding either practical or academic in their course of study. This misunderstanding is evident by such phrases as "although welding does not come under this department", and "your announcement is being referred to the Welding Department of our shops".

The Program is open to all students of engineering in *all* departments and the emphasis of the program is "Design for Arc Welding" and not on the technique of welding. Many managers and engineers in industry are effecting economies of labor and materials and improving designs without themselves being adept in the technique of welding. It is the aim of the Foundation in the present student program to prepare student engineers for this same activity in their active professional work to come in the future.

It would be unfortunate if students in some areas were deprived of the opportunity of participating in this program on the mistaken impression that a technical knowledge of arc welding is necessary. The necessary background can be acquired by any student in a very few hours of reading.

Record Creep Test

A 100,000-hr high-temperature creep test—the longest on record—for four rods of high-strength alloy steel has been completed in the Research Laboratory of the General Electric Company.

The four specimen rods, which were imprisoned in a thermostatically controlled electric furnace when Herbert Hoover was in the White House, repre-

Your Blueprint for
MORE POWER
starts with
OAKITE CLEANING

...Keeping Lube Oil Coolers Free From Insulating Deposits

More power is needed to meet the Nation's war demands. One way you can help is to get maximum output from your own equipment by keeping it in CLEAN, EFFICIENT operating condition.

To keep lube oil coolers, for example, free from lime-scale, rust, carbonized oil or other insulating deposits, just circulate the recommended Oakite solution through the water side or oil side of the cooler as directed. Then rinse. Upon inspection you'll find that ALL accumulations have been speedily yet SAFELY removed. Normal heat transfer efficiency is fully restored. And because no dismantling is required, man-hours are saved . . . units are returned to service without undue delay!

WRITE FOR FREE MANUAL
giving time-saving tips for cleaning lube oil coolers, preheaters, jacket-water coolers, feedwater heaters, evaporators, transformers.

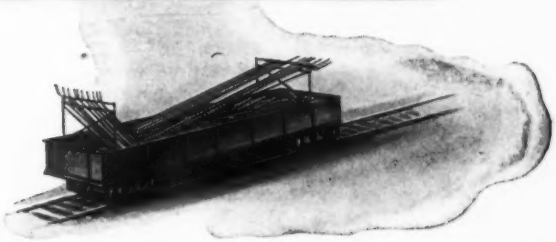
OAKITE PRODUCTS, INC.
23 Thames Street, New York, N. Y.
Technical Service Representatives Located in All Principal Cities of the United States and Canada

Buy Bonds for Victory
OAKITE *Specialized cleaning*
MATERIALS & METHODS FOR EVERY CLEANING REQUIREMENT

A hundred thousand tube-miles of B&W experience

Experience gained by The Babcock & Wilcox Tube Company in manufacturing and distributing more than one hundred thousand miles of seamless steel boiler tubes is inherent in all B&W Tubes—apparent in the quality and dimensional accuracy of the tubes received—in the competent, complete service performed by B&W Tube Distributors.

The Babcock & Wilcox Tube Company, closely allied with the world's largest boiler manufacturer, devotes its entire capacity to the production of specialty tubes rather than tonnage products—an additional guarantee that, even under the stress of war needs, the quality of B&W Seamless Steel Boiler Tubes is maintained.



Finally, B&W Tube Distributors are strategically located in thirty-three industrial cities.

BABCOCK & WILCOX TUBES

HOT FINISHED ALLOY STEELS
COLD DRAWN CARBON STEELS

THE BABCOCK & WILCOX TUBE COMPANY
BEAVER FALLS, PA.

TA-1213

THINGS YOU SHOULD KNOW

if you use pumps!

Things that make a big difference in performance between ROPER "hydraulically balanced" PUMPS and other pumps.

GEARS THAT FLOAT IN OPERATION SAVE YOU TIME AND MONEY! The pumping gears in ROPER "hydraulically balanced" PUMPS have hollow shafts so that internal pressure is equalized at all points. These gears are entirely separate from the drive shaft and are connected only by a sliding joint which permits them to actually "float" in operation. This sliding joint plus a special collar on shaft absorbs any shock or end thrust.

This feature means big savings in time and money for you because "hydraulically balanced" pumps are more efficient, last longer and permit periodic inspection of internal parts without disturbing piping or power unit.

REPLACEABLE BEARINGS GIVE PUMPS LONGER LIFE —The 4 large bearings (two on each side) in ROPER "hydraulically balanced" PUMPS are designed and constructed to withstand severe operating abuses and adequately handle peak loads. These flanged high lead bronze bearings also act as wearplates to protect face and backplate from wear. Can be replaced easily and inexpensively.

ROPER MECHANICAL SEAL REDUCES POWER REQUIREMENTS — Each ROPER "hydraulically balanced" PUMP is regularly equipped with a Roper Mechanical Seal. It saves money by reducing power consumption and keeps leakage to a minmum. Especially desirable where re-packing is not practical — that also saves you time and money.

HYDRAULICALLY BALANCED

THIS SEAL appears on every ROPER "hydraulically balanced" PUMP. It means higher efficiency, quieter operation, greater dependability and longer life.

SAVES FLOOR SPACE—ROPER PUMPS are designed to operate at direct motor speeds, thus eliminating gears, belts, etc. . . . saves space, and what plant doesn't need more space?

ALWAYS PRIMED — Once primed and in operation a Roper will always pick up its own prime — ready for instant action.

AS DEPENDABLE AS OLD FAITHFUL — That is the reputation earned by dependable performance year in and year out.

FREE CATALOG

Send for your free copy of Catalog 944 It contains complete information on 16 different sizes of Roper Pumps. Learn how you can save money and trouble on your pumping problems.

★

THIS HAPPENED FROM COAST TO COAST

United Air Lines say this about Roper Pumps on their refueling tank trucks . . . "first, they are SPEEDY and DEPENDABLE . . . second, their QUIET operation makes them ideal for refueling sleeper planes . . . third, they are the most EFFICIENT we have ever used . . ."

★

THIS HAPPENED IN ILLINOIS

A manufacturing plant was using five pumping outfits . . . average life of each pump, 16 hours and cost per pump, $46.65. Roper analyzed the problem and made recommendations. RESULT — average life of pump was s-t-r-e-t-c-h-e-d to 13 months. Net saving to customer in 13 months — $29,690.00.

★

THIS HAPPENED IN OHIO

Weaver-Wall Co., Cleveland, use Roper Pumps for pumping hot asphalt at temperatures up to 400° eight hours per day in the winter, twenty-four in the summer. Some test! But Roper Rotary Pumps endured for more than 12 years.

ROPER *Rotary* PUMPS

GEO. D. ROPER CORP. ★ ★ ★ ROCKFORD, ILLINOIS

sented one of the best known alloy steels for high-strength forgings and bolts required in the manufacture of steam turbines.

The test was made to determine what stresses could be used at temperatures where all materials are plastic, without causing deformations larger than the minute values tolerable in high-speed machines.

The results of the test are believed to represent the first 100,000-hr data made available for design use. Ordinarily, creep tests are run for only 1000 to 3000 hours.

Harte Cooke, American Locomotive Co, Dies

HARTE COOKE, 71, senior engineer of the Diesel Engine Division, American Locomotive Co, Auburn, N. Y., died at his home in Auburn on Dec 14, 1942.

Mr Cook attended Rensselaer Polytechnic Institute, Troy, N. Y., and in 1892 went to Auburn as a draftsman for McIntosh & Seymour Corp, builders of steam engines. The corporation began building diesel engines in 1913. By that time Mr Cooke had become a member of the firm. In 1929 the corporation became associated with American Locomotive Co.

At the time of his death he was an instructor of U. S. Navy personnel stationed at Cornell University and was a member of the National Defense Research Committee.

He was vice-president of the A.S.M.E. in 1937 and served for 20 years as a member of its Power Test Codes Committee.

Joshua Hendy Purchases Pomona Pump Co

Charles E Moore, president of Joshua Hendy Iron Works, Sunnyvale, California, has announced the purchase of the Pomona Pump Company of Pomona, California, and its recently acquired subsidiary, the Westco Pump Division, St. Louis, Missouri. Hendy also purchased the plant and equipment of the Hydril Company, Torrance, California to supplement the facilities available at Pomona.

The Hendy interests now embrace four of the major engineering fields: mechanical, electrical, hydraulic and steam, with steam engines, turbines, electric motors and generators, flexible couplings and pumps, as well as ship propulsion equipment and large gear reduction units.

One of the most vital problems facing industry today concerns the need for salvaging and reconditioning such hard-to-get equipment as valves.

Very fortunately for plants all over the country, there is a comparatively simple answer to this problem . . . Dexter Valve Reseating Equipment.

Dexter Valve Reseating Equipment not only saves the life of your valves . . . but will also reseat them on the line, quickly and easily. Any mechanic can do it. And because Dexter Cutters are available for monel, stainless, stellite, brass and bronze, Dexter Equipment will reseat *any* make of valve . . . making them as good or better than new.

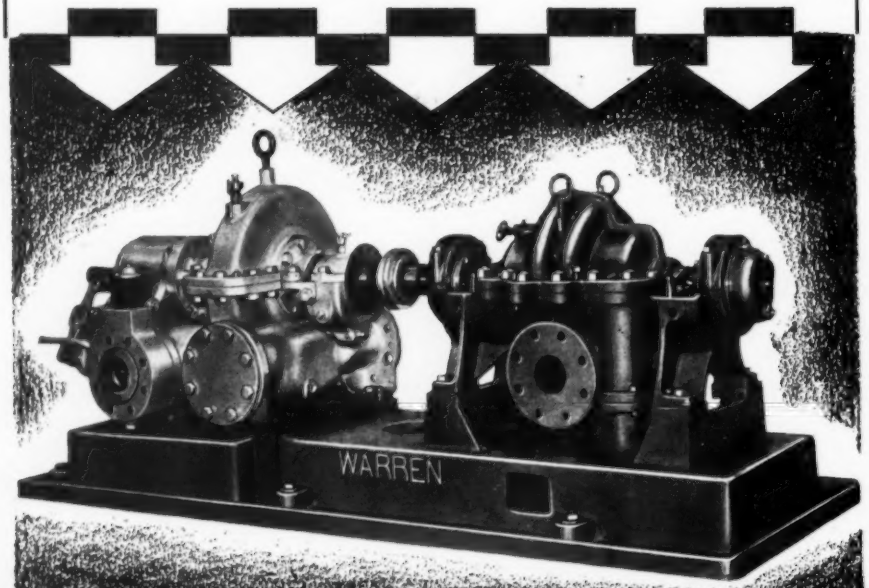
Dexter Valve Reseating Equipment has been performing its valuable services for more than fifty years . . . but today it is more essential to you than ever. Write for further information today.

Dexter Valve Reseating Machines

CAPACITIES: *Globe Valves, 1/4" to 14"; Gate Valves, 1 1/2" to 48"; Pump Valves, 2" to 15".*

THE LEAVITT MACHINE CO., 102 EAST RIVER STREET, ORANGE, MASSACHUSETTS

Some QUESTIONS and ANSWERS about



WARREN PUMPS

Here are some questions that are frequently asked our engineers by buyers of Warren Pumps.

QUESTION: Will the Warren Pump you recommend meet the *exact* requirements of the job it has to do?

ANSWER: Yes. *Every* Warren Pump is "built to fit the job." That has always been the Warren Policy.

QUESTION: Will the pump stand up under today's gruelling schedules—work 24 hours a day, 7 days a week?

ANSWER: Yes. All Warren Pumps are designed, engineered and built to give economical, uninterrupted performance. They have *good details.*

QUESTION: What are some of these good details?

ANSWER: Liberal clearances that assure highest practical efficiencies and low power costs, year in and year out . . . extra heavy shafts that minimize internal wear . . . over-size bearings . . . broad-faced case rings . . . properly proportioned liquid passages.

We will be glad to answer any other questions that *you* might have concerning Warren Pumps. Write.

WARREN STEAM PUMP COMPANY, INC.

WARREN, MASSACHUSETTS

The Pomona Division has been, and will continue to be, principally engaged in the manufacture of vertical turbine pumps for all pumping applications. The Westco Division specializes in smaller sizes for domestic and industrial pumping jobs.

The factory at Pomona, California has, for some time, been furnishing Joshua Hendy with special parts and heavy castings for vertical triple expansion steam propulsion engines for Liberty ships. They will continue to do so in the future.

The recently acquired Crocker-Wheeler Division, with factory at Ampere, New Jersey, is a pioneer manufacturer of electric motors, generators and flexible couplings. A sizable portion of their production is now for maritime use.

U S Production

The United States produced more metals and minerals in 1942 than at any time in its history, Secretary of the Interior Harold L Ickes stated recently on the basis of a year-end report from the Bureau of Mines.

The value of all mineral products produced in the country in 1942 soared to a record figure of more than 7½ billion dollars, exceeding by 8% the peak year of 1920 when prices were abnormally high following the first World War, and topping the 1941 level by 10%, according to the estimates submitted to Secretary Ickes.

Increased demands for wartime weapons and materials, expanded domestic needs, and higher prices contributed to the 1942 record, the Bureau of Mines reported.

"All branches of mineral production shared in this achievement, which is an outstanding contribution to the Nation's war program by the mineral industries," Secretary Ickes said. "But despite this record our production is still insufficient for current demands and there is no justification for complacency."

With a total estimated value of $7,525,000,000, the mineral production figures were broken down to show the value of metallic products as $2,330,000,000; mineral fuels, $4,060,000,000; and other nonmetallic minerals, $1,135,000,000. Larger values are anticipated in 1943.

Copper production also established new marks, while chromite, molybdenum, vanadium, tungsten, cadmium, barite, fluorspar, potash, phospate rock and highgrade clays also achieved record outputs. Domestic manganese

. . . ON THE FAR-FLUNG FRONTS OF GLOBAL WAR

In action with our fighting forces all over the world are "silent secret weapons" like these Cleaver-Brooks units . . . contributing to the health and welfare of our troops on far-flung fighting fronts.

Cleaver-Brooks' portable shower bath units —disinfecting, sterilizing, and water distilling equipment help our fighters to keep fit for action! Cleaver portable bituminous boosters and tank car heaters permit miracles in speedy construction of airports, military roads, supply roads, and many other facilities vital to supremacy in modern warfare.

On the home front, Oilbilt steam plants are providing low-cost steam for power and processing needs in hundreds of industrial and ordnance plants. All of this equipment is fired with the universal and ideal fuel — OIL! The multi-pass, down-draft heating principle with fuel-oil —first made famous in Cleaver tank-car heaters, bituminous boosters, and Oilbilt steam plants —finds a vitally important application in these "silent secret weapons" of our military services.

Now manufactured for a nation at war, Cleaver-Brooks' equipment will resume its peacetime applications when Victory Day is here.

CLEAVER-BROOKS COMPANY · 5109 N. 33rd STREET · MILWAUKEE, WISCONSIN

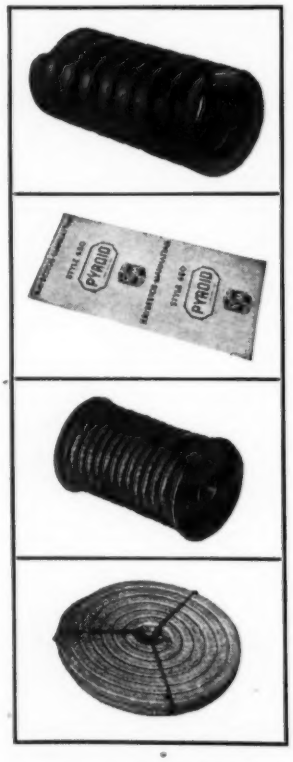
CLEAVER-BROOKS COMPANY • MILWAUKEE, WISCONSIN

It Beats the Dutch how R/M PACKINGS HOLD

That thumb-in-the-dike business was probably a bedtime story, but it showed the value of little things in resisting pressure. R/M packings "hold that line" under today's increased pressures . . . in steam lines, oil lines, fuel lines, and air lines.

As American production increased to an all-time high, R/M engineers did the necessary to step-up the efficiency of R/M packings. Failure is not in their formula. Success is their sign for security. Stick to R/M packings the way they stick to their job.

Do you have a copy of the R/M catalog? It's keyed for applications, illustrated, and indexed as to materials and types. Get a copy from your R/M distributor, or write us direct.



Awarded to R/M North Charleston Plant.

INDUSTRIAL SALES DIVISION
RAYBESTOS-MANHATTAN, INC.
MANHEIM, PA.
BRIDGEPORT, CONN. NORTH CHARLESTON, S. C. PASSAIC, N. J.
Makers of Packings for Every Industrial Use

ore production was the largest on record since the last war.

Despite difficulties in obtaining equipment and a large turnover in manpower, bituminous coal production in 1942 reached 576,000,000 net tons, which was a 13 percent increase over 1941 and nearly equal to the Nation's all-time peak production of 579,386,000 tons in 1918, according to preliminary estimates of the Bituminous Coal Division. Pennsylvania anthracite production increased 7% over 1941 and was the highest since 1930. The combined production of by-product and beehive coke was the highest in history and represented a gain of more than 5,000,000 tons over 1941.

Minerals used in construction were on the upgrade generally, with cement sales increasing 10%, sand and gravel up 7%, and stone, about 9%.

A slight decline in crude petroleum production was reported as the result of transportation difficulties which necessitated regional restraints on consumption, although there was a gain of 3% in value over 1941.

Wartime Pump Care

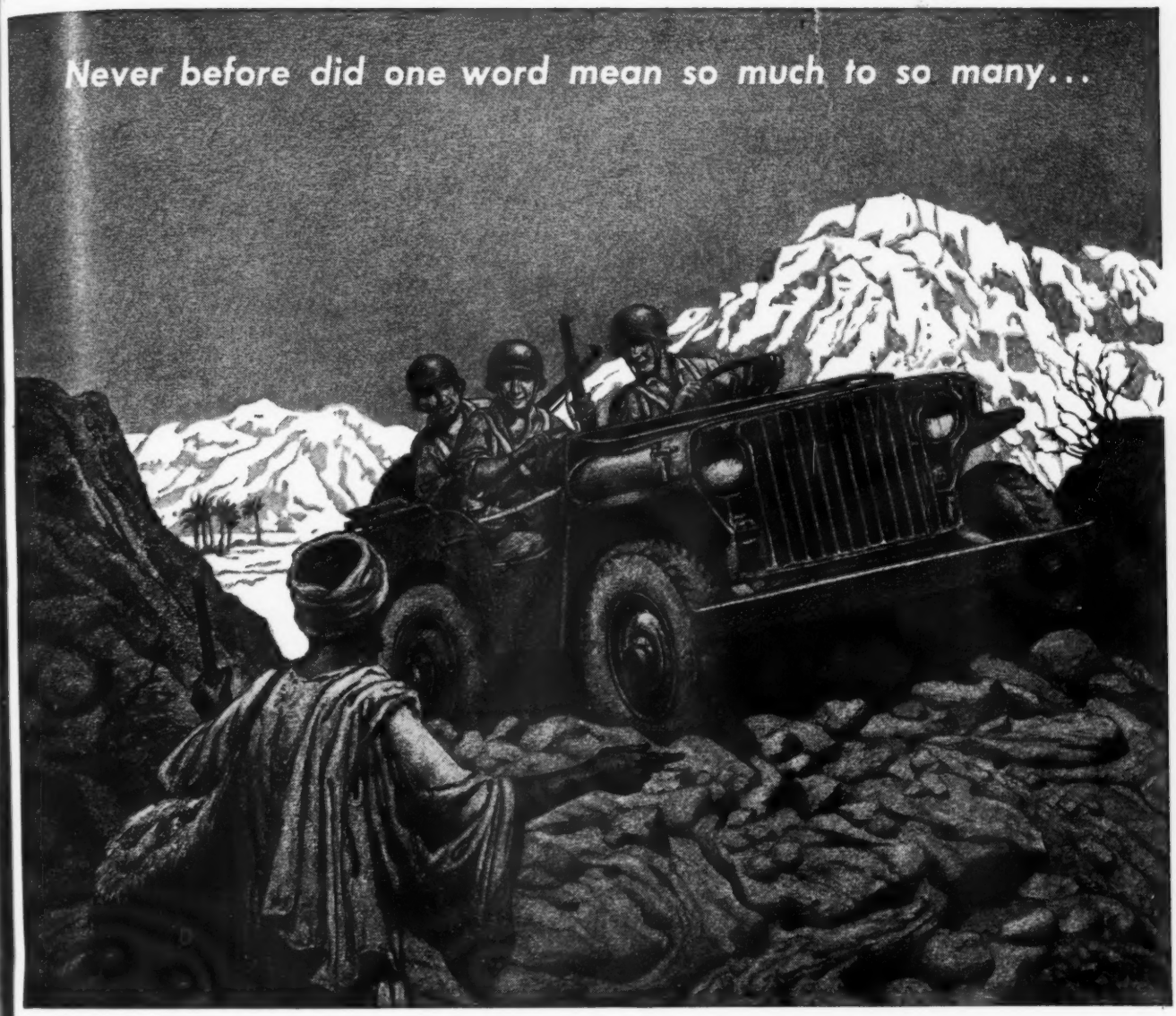
Allis-Chalmers Mfg Co, Milwaukee, has just released an important maintenance manual—"Handbook for Wartime Care of Centrifugal Pumps." It is part of a series which already includes books on the wartime care of motors and V-belts.

Like motors and drives, pumps are being pushed far beyond normal capacities, and many pumps that worked 1800 hours in a peacetime year are now working 8700 hours a year, according to Allis-Chalmers. Consequently, a new standard of pump care has been set forth in this important new handbook as a necessary solution.

Abundantly illustrated, Allis-Chalmers' new maintenance guide makes specific recommendations for putting pump care on a wartime basis. Step by step a centrifugal pump is actually built, and as each part is added, the way it's built and functions are seen to determine the way it should be cared for.

Valuable wartime tips included in the book describe: How a change in liquid can blitz a pump, easy ways to find leaks, common mistakes in packing stuffing boxes, how tight is "too tight" for a gland, how to figure head, how to protect pumps against cavitation, the vital role of water as a lubricant in pumps, quick diagnosis of pumps' ills, and many others.

The new manual applies to all makes



You can serve by CONSERVING

Name a continent . . . and you've named an American battlefront. From Tunisia to Timor, from India to Iceland, Americans and their Allies face a need for more arms and equipment . . . more tanks and trucks, more planes and ships and guns.

And those modern weapons need alloy steels in vital parts. Nickel steels, for example, that provide extra toughness, strength and added resistance to shock and impact. No need to tell you how essential these qualities are to the equipment of our armed forces.

That's why it's so important to *conserve* critical alloys. Every possible pound must be saved for our fighting men.

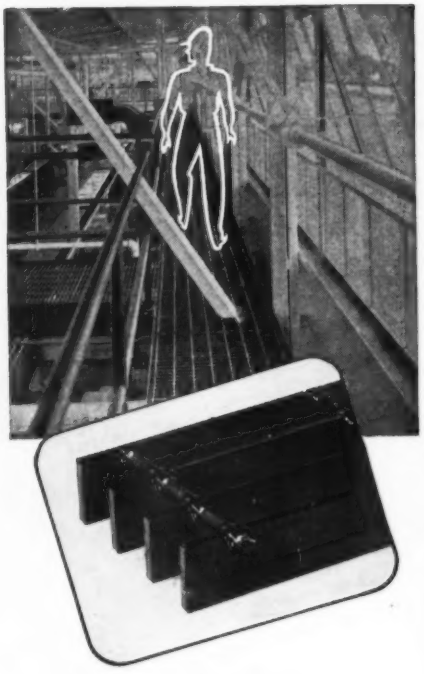
The best way to help is by making sure all metal scrap in your plant is properly segregated. Collect ferrous and non-ferrous scrap, in separate containers, at the machines where generated.

High-speed tool steels and alloyed constructional steels should also be collected and salvaged separately. When in doubt . . . segregate!

If metal problems are bothering you—if you would like suggestions for extending your own metal conservation program—call on our technical staff for "CONSERVICE,"—a new name for counsel and data that will help you conserve.

* * **Nickel** * *

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK, N. Y.



YOU CAN SEE THE EXTRA STRENGTH AND CLEANLINESS OF

BATES-GRATES

FOR OPEN STEEL FLOORING AND STAIR TREADS

That BATES fillet weld gives you the full strength of the original steel of main and cross bars, *without dirt-catching overflow of surplus metal around the fillet.* That's important.

Just as important, note that crisp, clean tread the entire length of cross bar—a feature you can get only with BATES Hex Cross Bar construction.

You can have these definite advantages at no extra cost by specifying BATES-GRATES for *your* flooring.

8½" x 11" BOOKLET GIVES DETAILS. SHOWS MANY INSTALLATIONS

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WRITE FOR COPY

WALTER BATES COMPANY, INC.
1707 ROWELL AVENUE • JOLIET, ILLINOIS
OPEN STEEL FLOORING • STAIR TREADS

of pumps and contains no advertising. Copies can be obtained free of charge by writing the Allis-Chalmers Mfg Company, Milwaukee, Wisconsin.

Order No. P-46 For Utilities

The new 60-day inventory limitation of primary shapes and forms of copper, steel and aluminum—including all types of wire and cable—imposed by WPB under the Controlled Materials Plan is not expected to apply to utilities. A special directive is in the works exempting companies under Order P-46 from the inventory order, known as CMP Regulation No. 2.

Issuance of such a directive will mean that inventory control regulations in Paragraph F of P-46 will continue to apply to utility operations. The exemption is a recognition by WPB that utility inventories, generally, exceed a 60-day supply of copper wire but that a forced reduction to that level would result in an inefficient immediate use of "surplus" stocks and would require continuous fabrication from new metal supplies. WPB's Power Division is setting up an inventory control plan for using existing copper stocks in utility warehouses where they will be most effective to the war effort (*Electrical World*, Jan 2, p 3).

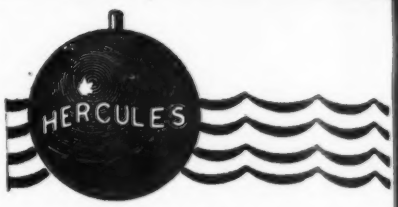
CMP Regulation No. 2 is designed to hold the aluminum, copper and steel inventories of manufacturers and other users, where practical, to a maximum of 60 days' forward requirements. Acceptance of deliveries after April 1 is prohibited if delivery would increase inventories beyond prescribed limits. The controls are applicable item by item as listed in the regulation, although provision is made for acceptance of specified minimum economic quantities.

TVA Capacity Increased By One-third in 1942

Generating capacity of the Tennessee Valley Authority was increased by almost one-third to 1,374,500 kw and its generation of power exceeded six billion kilowatt hours during the fiscal year ended June 30, 1942, the agency reports. The annual report is not being published in full because it contains data "which might give aid, though certainly not comfort, to the enemy."

Indicative of TVA's continued wartime growth, a footnote to the report pointed out that generation is now at a rate of ten billion kilowatt hours annually.

HERCULES
Seamless Copper
FLOATS



GUARANTEED TO STAND UP!

Every Hercules Float carries our guarantee to stand up under 350 lbs. working pressure and 500 degrees temperature.

Fabricated of seamless copper under our special spinning process. Hercules Floats are uniform in thickness and high in mechanical strength.

You can depend on Hercules for floats—in standard shapes up to 10 in. and in special types to your specifications—to give long, dependable, economical service.

Insure care-free maintenance of water level in your heaters, tanks, reservoirs and other equipment by specifying "HERCULES."

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your engineering library were limited to ONE book . . .

MARKS' MECHANICAL ENGINEERS' HANDBOOK

would give you greatest value as that book!

In Marks' Handbook you get 2276 pages of all the most frequently needed standards, data, authoritative descriptions of developments and advances in practice, in theory, in systematization of machine elements, materials, and processes in all branches of mechanical engineering. 102 engineers and specialists contributed data to make it practical and dependable. 4th edition. Over 1700 illustrations. $7.

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Send me Marks' Mechanical Engineers' Handbook for 10 days' examination on approval. In 10 days I will send you $7.00 plus few cents postage or return book postpaid. (Postage paid on cash orders.)

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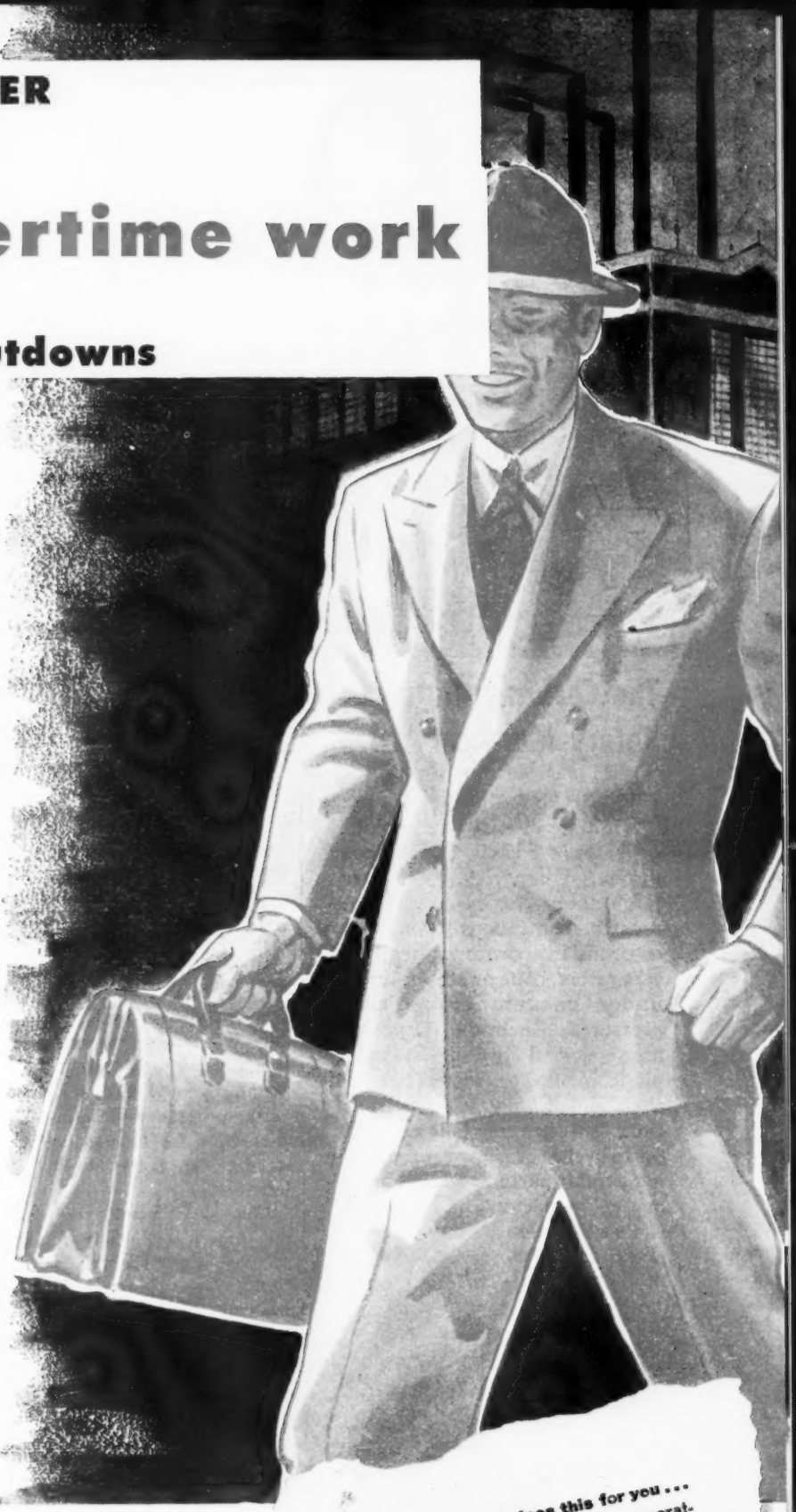
DEARBORN ENGINEER HELPS YOU TO...

educe Overtime work

due to untimely shutdowns



Power plant engineers do not object supervisory work that is necessary to eep boilers in full steaming condition. ut . . . it's aggravating to work over- me on shutdowns which may be pre- ented. That's where the Dearborn ngineer comes in to help you!

His frequent calls, to insure mainte- ance of recommended conditions, tend the period of boiler operation. o serve you, he does not have to travel ng distances because he lives and orks in your district.

He knows local water characteristics, o. And, he helps you to solve your roblems quickly.

The Dearborn laboratory provides him ith the facilities to develop corrective easures and to design the system of ontrol *especially for you.*

This service reduces costly repairs to minimum and makes possible more ntinuous operation. He's a good man r you to know. Write to us . . . we'll adly arrange for him to call.

EARBORN CHEMICAL COMPANY
Dept. D, 310 S. Michigan Ave.
Chicago, Illinois

Dearborn Engineer does this for you . . .

(1) *Studies* your water and plant operating conditions.
(2) *Sends* samples of your water to main laboratory for analysis.
(3) *Recommends* proper chemical treatment and chemical control methods.
(4) *Supervises* installation of feeding equipment.
(5) *Instructs* your men on water test methods for treatment dosage adjustment and blow-down control.
(6) *Calls* regularly to insure maintenance of recommended conditions.

Dearborn

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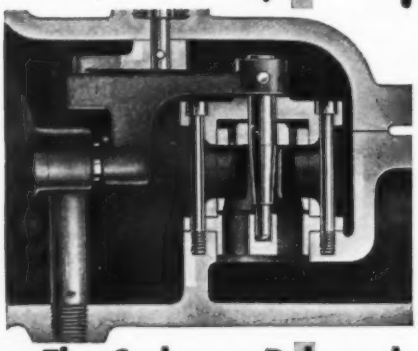
WATER TREATMENT AND ENGINEERING SERVICE

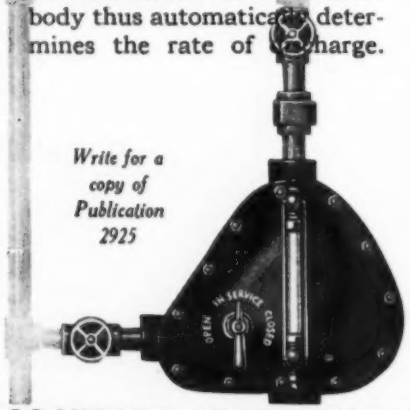
The Secret of this Drainers Great Capacity



The Cochrane Balanced Rotary Multiport Valve

COCHRANE DRAINERS are famous among power plant operators for their tremendous discharge capacity. Wherever large quantities of condensate must be continuously removed as from evaporators, heaters, separators, coils or steam lines, under vacuum or positive pressures, Cochrane Drainers are specified by experienced plant men. The secret lies in their multiport valve construction, a series of longitudinal parts in the rotary valve matching similar parts in the stationary valve sleeve. The height of the condensate in the drainer body thus automatically determines the rate of discharge.

Write for a copy of Publication 2925



COCHRANE CORPORATION
3106 N. 17th St., Philadelphia, Pa.

COCHRANE
STEAM SPECIALTIES

The report states that TVA completed and placed into operation during the fiscal year four dams and the Watts Bar steam station, started work on eight new dams (two of which also are in the completed list), continued work on four more, and completed a major tie-line with Northern steam systems to strengthen its ability to meet war demands in event of low water. The finished projects are Cherokee, completed in 16 months. Chatuge and Nottely, completed in less than a year, and the steam plant, now being enlarged. New projects started are Douglas, Fontana, Apalachia, Ocoee No. 3, Watauga and South Holston; work on the last two was subsequently halted by WPB order.

Midwest Power Conference To Be Held April 9 and 10

Stanton E Winston, director of the conference, a professor of mechanical engineering at Illinois Tech, has revealed that plans are now being made to hold the 1943 Midwest Power Conference as usual. As evidence of this fact, Mr Winston has also announced that a keynote speaker and a speaker for the "All-Engineers' Dinner" have already been secured.

C W Kellogg, president of Edison Electric Institute, New York City, will be the keynote speaker. Kellogg's place on the program will be in the nature of an encore, for he was one of the outstanding speakers at the 1941 conference.

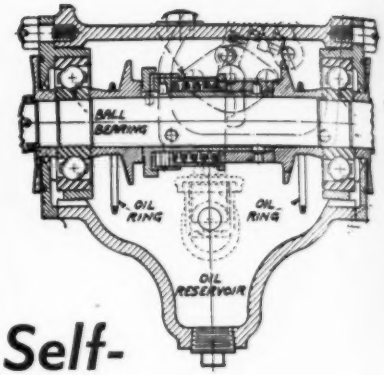
Colonel L Walsh, war chairman of the American Society of Mechanical Engineers, will be the speaker at the "All-Engineers' Dinner," the annual social highlight of the conference. His topic will be "Logistics, the Science of Survival."

Dates for the 1943 Midwest Power Conference will be April 9 and 10, 1943. Place, as usual, will probably be the Palmer House, Chicago.

Decision to continue the conference, according to Director Winston, was prompted by the fact that there seemed to be a considerable demand for the meeting as a stimulus for the production of power in the war effort. The conference has been endorsed as a vital meeting by government officials.

"Power for Victory" has been adopted as the motto for this year's session, the second in war time.

As was the case last year, all of the



Self-Lubricated

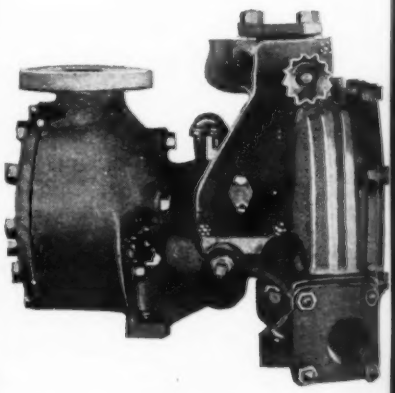
The COFFIN-Steam Turbine CENTRIFUGAL PUMP

Self-contained ring type lubrication, supplied from a centrally located oil reservoir within the housing, makes the Coffin pump independent of external lubricators.

The oil level is maintained and the reservoir refilled by means of the single oil cup provided.

The temperature of the oil in the reservoir is water cooled by means of a continuous coil when cooling is required.

PRESSURES
To 750 Lbs. Sq. In.
DELIVERIES
To 500 G.P.M.



THE J. S. COFFIN, JR., CO.
ENGLEWOOD, N. J.

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PRE-FABRICATED PIPING
IS Better PIPING

When you need either a simple pipe bend or coil . . . or complete and alloy piping for power plant or complex industrial process . . . you will find it advantageous to use Midwest Pre-Fabricated Piping (whether purchased on the basis of materials only or materials completely installed).

An organization of specialists devoted entirely to the piping business and plants having the most modern equipment assure pre-fabricated piping that is accurate in dimension and alignment, carefully shop tested, thoroughly cleaned and inspected, heat treated and stress relieved when necessary.

Nationwide experience in satisfying the piping needs of all types of industries and an aggressive program of piping research enable Midwest frequently to make suggestions that simplify piping layout . . . save time and materials . . . and reduce costs.

MIDWEST PIPING & SUPPLY CO., Inc.

Main Office: 1450 South Second St., St. Louis, Mo.

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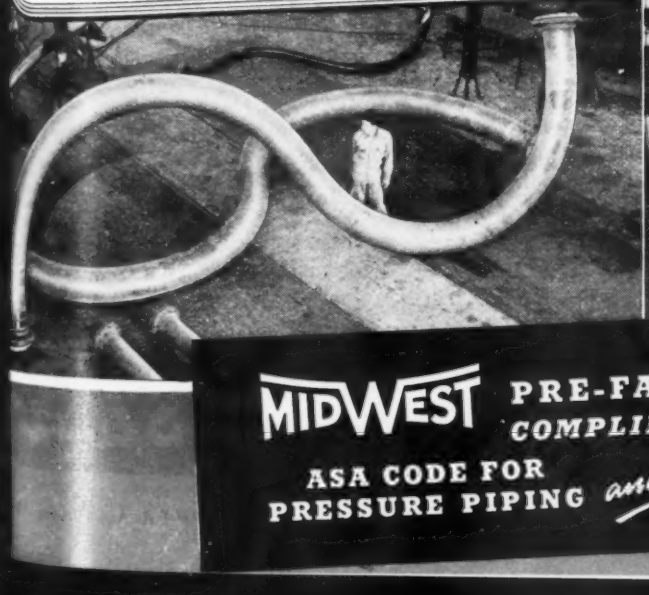
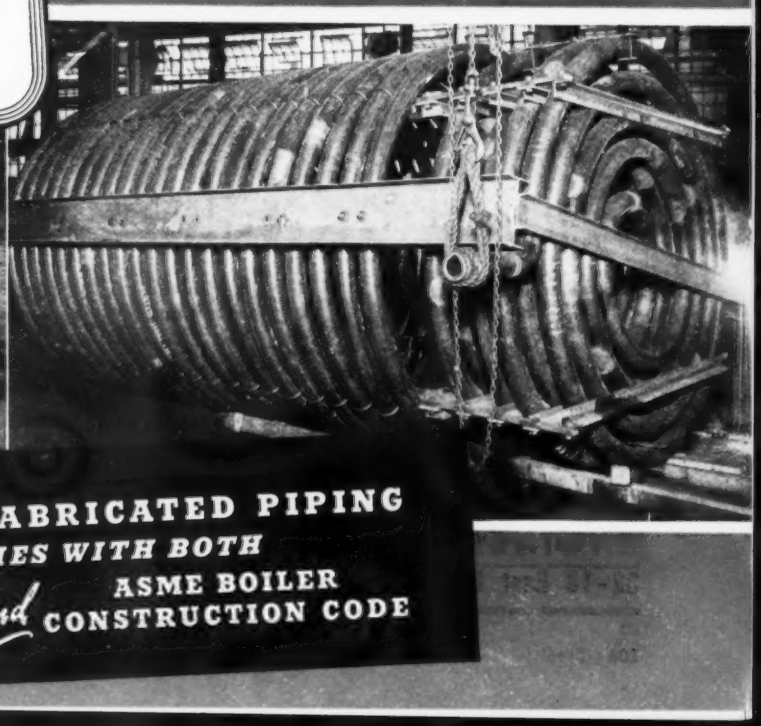




MIDWEST PRE-FABRICATED PIPING *COMPLIES WITH BOTH* ASA CODE FOR PRESSURE PIPING *and* ASME BOILER CONSTRUCTION CODE

FYR-FEEDER

BURN COAL LIKE OIL!

American Coal Burner Company
16 East Erie St., Chicago, Ill.

Gentlemen:-

I wish to take this opportunity of congratulating you upon the excellent stoker which you have furnished us. We have used your stoker continually for about six weeks, namely, during the time we were putting up our pea pack. This is the time of the year when the greatest stress is put upon men and machinery and I must say that your stoker came through with flying colors.

Never before have we had such even steam pressure and such a maximum amount of driving power. Your FYR-FEEDER burns up the coal most uniformly, thereby getting the utmost heat out of the fuel, and leaving very little waste.

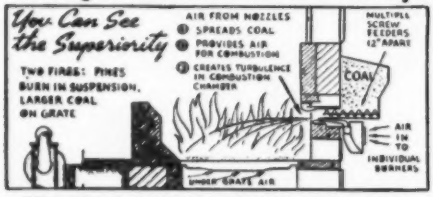
Needless to say, this has resulted in a saving for us both in labor and fuel, and at the same time increasing the output which we were so much in need of. I would not hesitate to recommend this stoker to my best friend.

Sincerely yours,
(Large Packing Plant)

Name on request

QUICK DELIVERIES
for all industrial applications

ACT now to protect yourself against *FUEL SHORTAGE, steam shortage and manpower shortage.* WRITE or WIRE today.


You Can See the Superiority
AIR FROM NOZZLES
1 SPREADS COAL
2 PROVIDES AIR FOR COMBUSTION
3 CREATES TURBULENCE IN COMBUSTION CHAMBER
MULTIPLE SCREW FEEDERS 12" APART
TWO FIRES: FINES BURN IN SUSPENSION, LARGER COAL ON GRATE
COAL
AIR IN TO INDIVIDUAL BURNERS
UNDER GRATE AIR

MULTIPLE BURNER SPREADERS ARE ADVANTAGEOUS AND NECESSARY
Each FYR-FEEDER has 2, or 4, or more burner spreaders giving dependability and convenience in cleaning grates, impossible to secure with a single spreader.

AMERICAN
COAL BURNER CO.
ENGINEERS, Est. 1918
32-18 East Erie St., Chicago, Ill.

discussions and talks will be centered around wartime power problems.

The proposed agenda for the 1943 conclave, according to Mr Winston, an administrator of the Midwest Power Conference since its reorganization in 1938, will feature industrial plants, their protection and maintenance. Other topics will include diesel power and fuels and combustion.

As in former years, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers will each sponsor a luncheon.

While the complete program is yet in the embryo stage, Mr Winston states that several speakers have already signified their willingness to appear on the program. As usual, Mr Winston says, the program will feature the best-known men in the field of power.

Budget Effect On Utilities

President Roosevelt's $109-billion-dollar war budget contains no recommended appropriations of new funds for construction of Federal power plants. The Government power agencies—Tennessee Valley Authority, Bonneville Power Administration and the projects of the Bureau of Reclamation and the U. S. Army Engineers—all are listed to carry on their reduced schedule of expansion in the fiscal year beginning July 1 with unexpended balances from the current year and from their own revenues.

Only new grant of funds in the Budget is for the Rural Electrification Administration which the President proposed be given $30,000,000 additional borrowing credit on Reconstruction Finance Corp. funds. REA was allowed $10,000,000 in new funds for the current fiscal period, but an unexpended balance of nearly $30,000,000 more from the 1941-42 fiscal year's $100,000,000 allowance also was available to the agency.

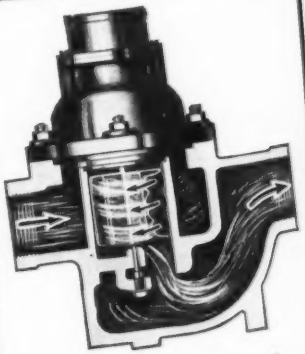
The lack of new appropriations doesn't mean that the Federal power agencies will be bereft of funds at the end of the current fiscal year. Due both to the fact that WPB has halted a number of Government projects in its over-all curtailment of both public and private power plant expansion, and to the sharp increase in revenues of the operating agencies, all of them will have money to complete scheduled construction. TVA's expenditure for the 1943-44 year are estimated at approximately $60,000,000—less than one-half the current year's pace—but figures for the other projects are not available.

HENSZEY
BOILER FEED WATER
METERS
can measure it!

This war of production has brought to light some unusually difficult measuring problems. In many cases the HENSZEY Boiler Feed Water METER has been able to do the job where most ordinary meters failed.

Why? Because the Henszey Meter was developed to measure hot, dirty corrosive boiler blowdown. There are no close clearances to cause trouble. There are a minimum of moving parts. The Henszey Meter is equally accurate at high or low flow, high or low pressure, on reciprocating, duplex, triplex or centrifugal pumps. It can be calibrated to read in gallons, pounds or cubic feet at any specified temperature. Sizes 10 to 600 G.P.M., cold water steady flow rating. Connections: ¾" to 6". Special sizes to order.

HENSZEY COMPANY
Dept. D2 Watertown, Wis.



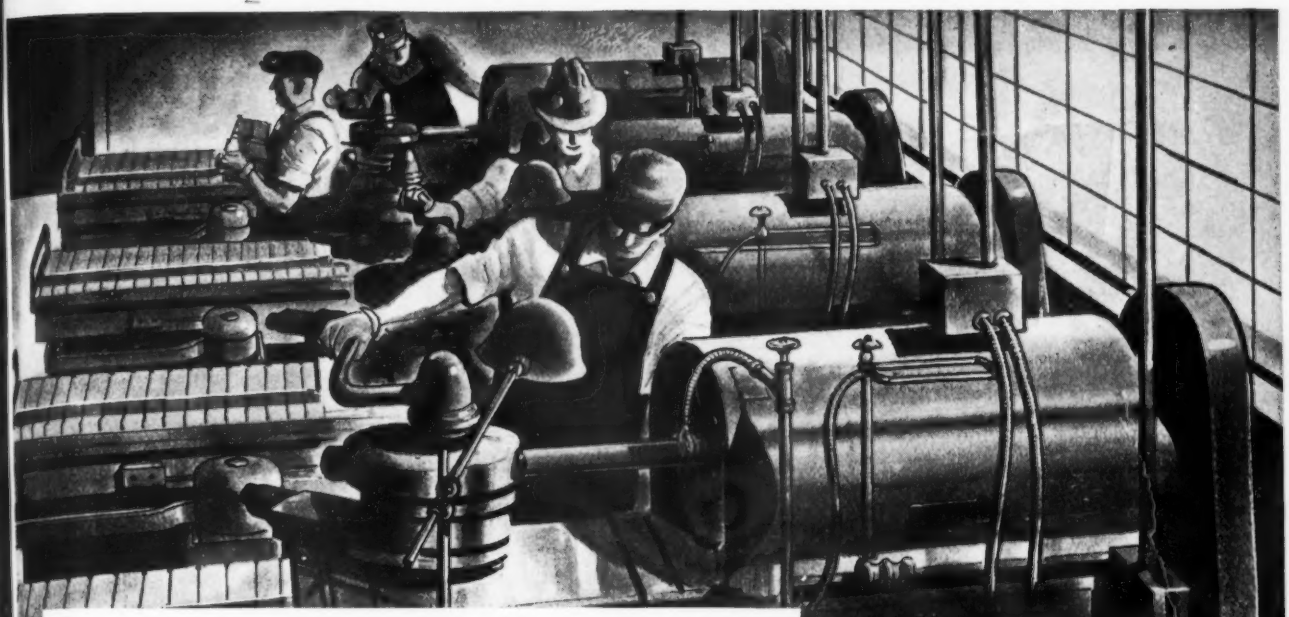
Here's how it works

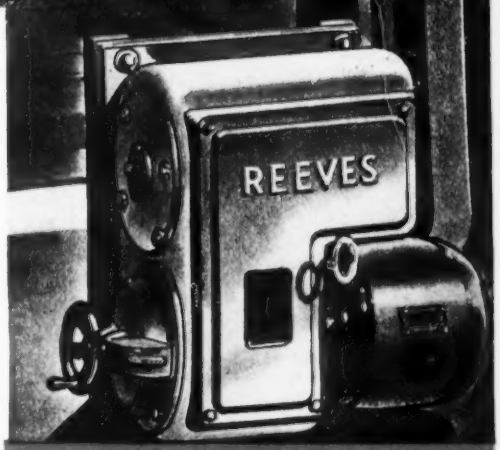
Water enters the measuring chamber tangentially, spinning in the chamber as it passes through, forming a vortex. Each gallon that passes through this chamber makes the same number of revolutions of the water. A vane is placed in the rotating water to impart this rotation to the register.

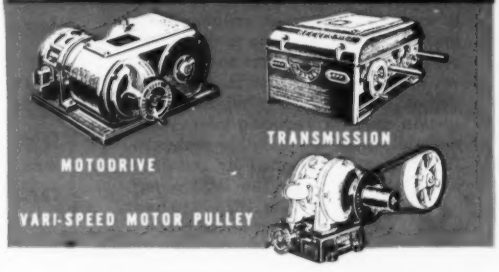
HENSZEY

They made 4 machines do the work of 5

by installing REEVES Variable Speed Drives







★★★ Twenty-five per cent more output of gun parts, *with no extra machinery, no extra labor and no extra floor space,* is one way to win the battle of production and beat the Axis.

A Detroit machine shop accomplished this increase by installing REEVES Variable Speed Drives on the lathes *they had.* This not only made four machines—*and four operators*—do the work of five, but gave greater precision in machining. These results are not unusual. Productive capacities of men and machines are often doubled with REEVES units, which provide full-range, stepless speed adjustability. Operators can always run REEVES-equipped machines at the *best* speeds for each changing condition.

The faster tempo of the war dictates use to the limit of plants we have *right now*—and REEVES Speed Control, available in many models and sizes, insures increased output and greater accuracy on all types of driven machines *now in service.* Standard on 1,440 different makes of new machines. Booklet MG-423 tells the story. Write for it.

REEVES PULLEY COMPANY • COLUMBUS, INDIANA

REEVES *Accurate Variable* SPEED CONTROL

OIL REFINERY USING

ADAMANT
FIRE BRICK CEMENT

SAVES 50%

on annual repair costs
for fire-brick construction

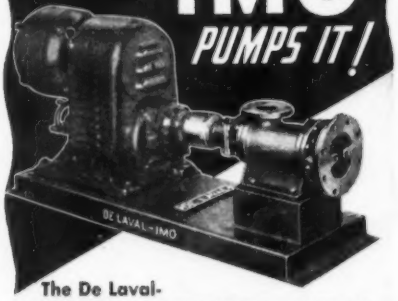
That is the estimate of a refinery using Adamant in building fire brick construction in boiler furnaces, still settings and tube heaters. These savings result from the high bonding strength of Adamant which impartial laboratory tests prove to be 800 lbs. per sq.in. at room temperature; 1270 lbs. per sq.in. at 2600° F. We'll gladly send you complete details about Adamant. Write us today.

ADAMANT has a P. C. E. of over 3000° F.

BOTFIELD
REFRACTORIES COMPANY

781 S. Swanson St., Philadelphia, Pa.
In Canada: Canadian Botfield Refractories Co. Ltd. 171 Eastern Avenue, Toronto

THICK or THIN
IMO
PUMPS IT!



The De Laval-
IMO ROTARY DISPLACEMENT PUMP
is used for viscosities ranging from that of thin Diesel oil up to the heaviest Bunker C. In the unit here shown, which handles a still stiffer fluid, the outboard end of the pump forms the suction opening, reducing inlet velocities and losses to negligible amounts. The output is controlled by the variable speed drive. • The IMO pump has no valves, no gears and no unbalanced or reciprocating parts. It pumps any oil against any pressure.

IMO
I MOVE OIL

Ask for Publication I-103

IMO PUMP DIVISION
of the De Laval Steam Turbine Company
Trenton, New Jersey

The Government's two principal regulatory agencies in the electric utility field each are modestly cut in recommended appropriations for 1944, compared to amounts made available for this year. The President listed Federal Power Commission for $2,720,255, a reduction of $70,500 made up almost entirely by a slash in the printing and binding account. FPC's special defense activities appropriations remain at $519,255.

The reduction for the Securities and Exchange Commission is $112,000, to $4,798,000. The agency's salary allowance is reduced by $100,000, to $4,750,000, and its printing fund from $60,000 to $48,000.

E C Terry Given Hospital Memorial

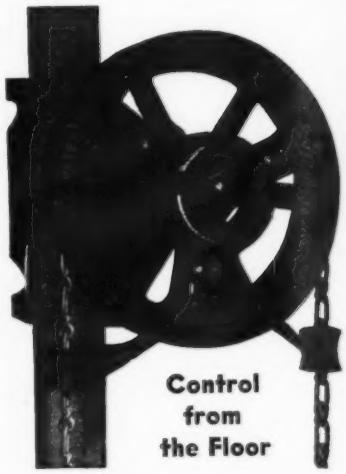
One-half of the entire surgical department in the new Hartford (Conn.) Hospital will be dedicated as a memorial to the late Edward Clinton Terry, founder of the Terry Steam Turbine Co, of that city, through a gift of $117,300 by his widow, Mrs. Louise E. Terry. In announcing the gift Chairman Barclay Robinson of the building fund memorials stated that "it is particularly appropriate that the man who produced an outstanding invention in the field of mechanical engineering should have as a memorial here in Hartford that particular part of our new hospital which reflects one of the most dramatic and useful applications of science in the medical field."

Engine Piston Rod Breaks

An operator who was standing beside a steam engine at a municipal power plant was startled by the sound of a heavy crash coming from the machine. He quickly pulled an emergency trip valve, which happened to be within easy reach, and stopped the engine within a few seconds. Investigation showed that one of the piston rods had broken approximately 18-in. inside the cross head.

The engine was a vertical uniflow type having four 18-in. cylinders, and was driving a 1000-kw generator. As far as could be determined it had been operating normally before the accident, but investigation showed that the break resulted from a progressive crack that had been developing at the base of the threads on the piston rods where the rod was screwed into the crosshead. The crack itself was the result of repeated stresses that had been set up

Make Your Overhead Valves SAFE And Easy to Reach---

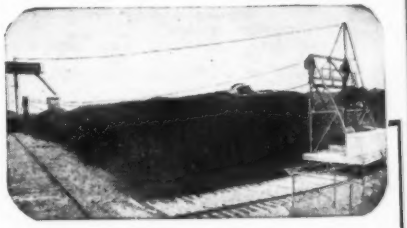


Control from the Floor

With the Babbitt Rim for Valves you eliminate danger and banish the step ladder. You can now place your valves whereve. hey come economically and conve..ently. They fit any valve. Let us tell you more about them. Write today.

BABBITT STEAM SPECIALTY CO.
New Bedford, Mass.

SAUERMAN
Power Scrapers



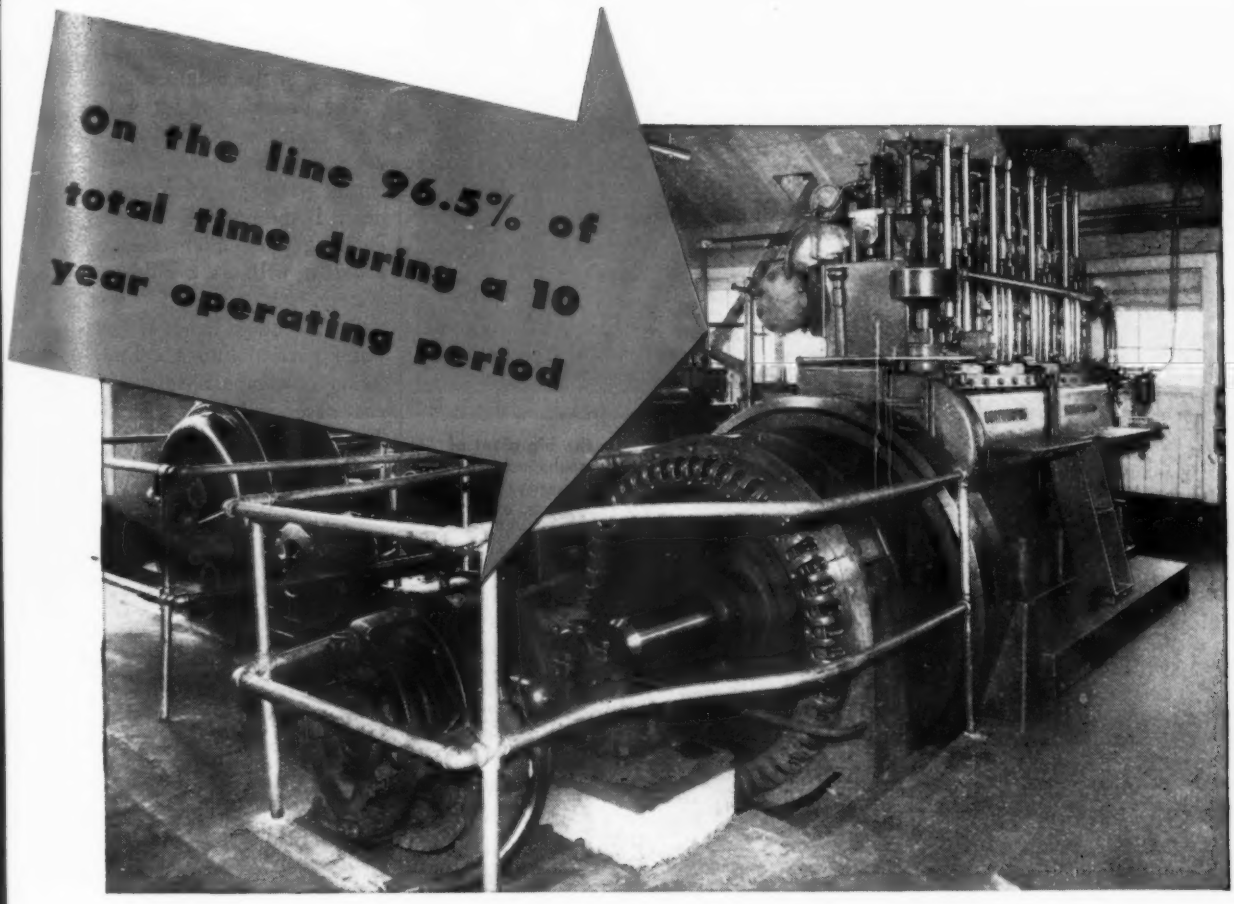
STORING COAL
—at lowest cost

At hundreds of power plants today Sauerman Power Drag Scrapers are storing and reclaiming coal at costs of a few cents per ton handled. This low cost is due to the rugged simplicity of the Sauerman equipment and its easy automatic operation.

Aside from its economy, the most important fact about this system is that it piles the coal in layers and avoids size segregation. There is little chance of spontaneous combustion when coal is piled in this manner.

Write for Catalog.

SAUERMAN BROS., Inc.
562 S. Clinton St. Chicago, Ill.



This remarkable record was achieved by the Worthington 300-hp. 4-cycle diesel engine shown above . . . forerunner of Worthington's present line of totally enclosed units.

Operating Time	78,487 hrs.
Load Factor	50%
Kilowatt Hours Produced	8,511,660
Cost of Repairs per KW. hr.	8/100 mills
Total Cost per KW. hr.	.702 cents

(Including fuel oil, lubricating oil, labor, repairs and supplies)

Such a record speaks for itself, and it is typical of the performance of the hundreds of Worthington diesel and gas engines that are carrying important parts of the United Nations' war power load.

DIESEL ENGINES 150 to 1500 hp.

CONVERTIBLE GAS-DIESEL ENGINES 150 to 1500 hp.

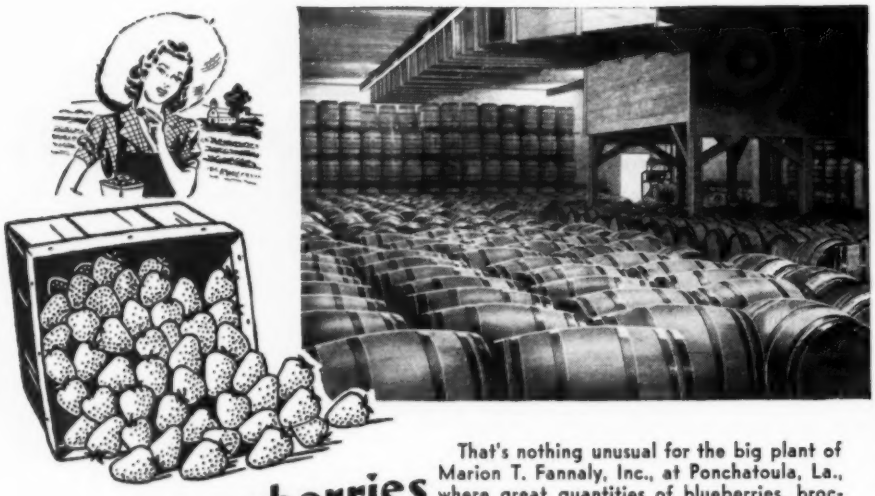
GAS ENGINES 175 to 2880 hp.

Both the Navy E and Army-Navy E Awards have been presented to Worthington for speed and excellence in production.

DE2-4A

WORTHINGTON

WORTHINGTON PUMP & MACHINERY CORPORATION • GENERAL OFFICES: HARRISON, N. J.



Fresh Strawberries -450,000 Lb. a Day- Quick-Frozen with

That's nothing unusual for the big plant of Marion T. Fannaly, Inc., at Ponchatoula, La., where great quantities of blueberries, broccoli, spinach, figs, frog legs, shrimp, oysters, and fish are also frozen in season. Eleven large Frick compressors, producing over 600 tons of refrigeration, carry the quick-freezing and storage loads, and make up to 140 tons of ice.

More frozen foods are prepared by Frick-Freezing Systems, we believe, than by any other method. Millions of pounds of these foods are being used daily by our Armed Forces. If you need dependable refrigeration for War Work, get in touch with

FRICK CO., Waynesboro, Penna.

TRADE FRICK MARK

Refrigeration

when small amounts of water had from time to time been carried over by the steam into the cylinder.

The presence of water in steam engine cylinders is one of the principal causes of disastrous failures of reciprocating parts, cylinder heads and cylinders. If the quantity of water suddenly entering a cylinder is large, a major accident will, as a rule, result immediately.

On the other hand, if the amount of water carried into a cylinder with the steam is comparatively small there is not necessarily an immediate breakdown of parts. But even a small quantity of water entrapped between the piston and cylinder head will, as a rule, cause serious overstresses in the weakest parts of the engine. Such overstresses are very likely to cause incipient cracks in the threads of piston rods or in crankbolts, and these cracks may progress to such an extent that a costly failure will result.

Engines of the uniflow type have hollow cylinder heads that act as steam jackets and also as the steam passages to the inlet valves. It is essential in vertical engines that the lower heads be kept continuously drained by means of a single automatic trap. It is unsafe to depend on hand-operated drain valves.

PLASTIC PATCH

Takes Traffic Immediately . . .

No traffic interruptions when you patch broken concrete with durable INSTANT-USE. Material comes ready mixed. Simply shovel into hole, tamp and run traffic over immediately—without waiting. Bonds tight to old concrete. Makes smooth, solid, lasting patch. Withstands extreme loads. Keep a drum on hand for emergencies. Immediate shipment.

REQUEST DESCRIPTIVE FOLDER . . . and Details of FREE TRIAL OFFER

INSTANT-USE

FLEXROCK CO., 2377 Manning St., Phila., Pa.

ROCKWELL BLAST GATES

Threaded Slide Type of Rockwell Blast Gate

For Accurate Control of Low Pressure Air

There are plenty of good reasons for the wide popularity of Rockwell Blast Gates. These air-tight, non-chattering blast gates are designed for strength, lightness and accurate control. Available in all desirable types, sizes and methods of operation. They save power . . . money . . . time. Write for Bulletin 4020 describing Rockwell Blast Gate advantages in detail.

W. S. ROCKWELL COMPANY

Blast Gate Division

50 CHURCH STREET NEW YORK, N. Y.

Manpower Report

Pointing out that war industries can make much wider use of facilities of the Apprentice and Training Service in efforts to solve manpower shortages, Chairman Paul V McNutt, of the War Manpower Commission, announced that, since February 1942, the agency has assisted an average of 1100 establishments monthly to organize on-the-job short-term training and apprenticeship programs.

"As the result of the work of this agency, thousands of production workers and skilled craftsmen have been made available to our war plants during the past ten months," Mr McNutt said, "Many thousands more can be added to our industries if employers, badly in need of trained workers, more fully utilize the agency and its field representatives.

"Apprentice and Training Service," the Chairman said, "is one of the WMC agencies charged with assisting industry to train workers under production conditions. Another agency in this field is Training Within Industry Service, while the National Youth Administration also provides a combination of

Guard YOUR turbines
with this oil that helps to

KEEP OUR SUBS ON THE PROWL!

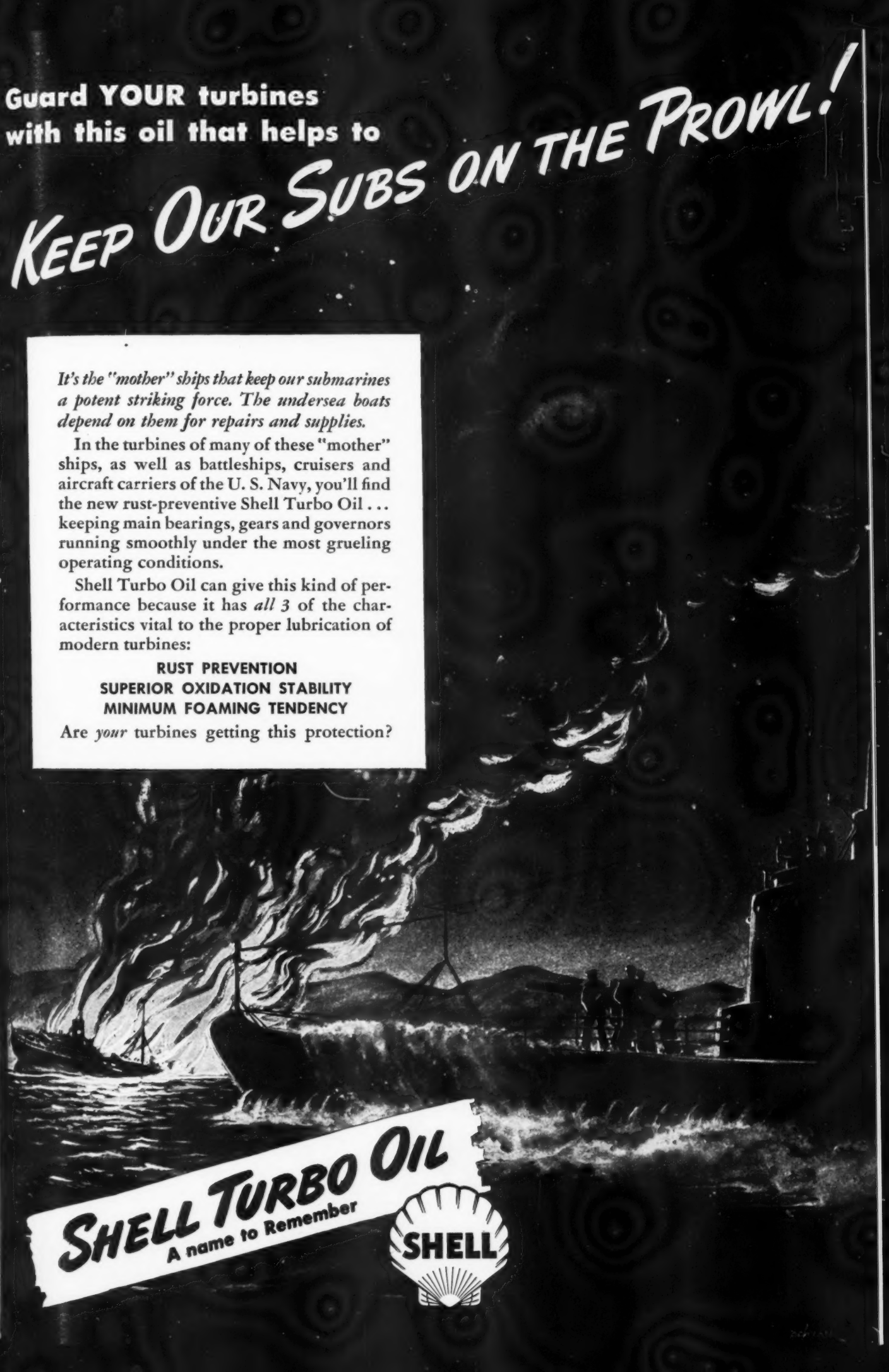
It's the "mother" ships that keep our submarines a potent striking force. The undersea boats depend on them for repairs and supplies.

In the turbines of many of these "mother" ships, as well as battleships, cruisers and aircraft carriers of the U. S. Navy, you'll find the new rust-preventive Shell Turbo Oil . . . keeping main bearings, gears and governors running smoothly under the most grueling operating conditions.

Shell Turbo Oil can give this kind of performance because it has *all 3* of the characteristics vital to the proper lubrication of modern turbines:

RUST PREVENTION
SUPERIOR OXIDATION STABILITY
MINIMUM FOAMING TENDENCY

Are *your* turbines getting this protection?

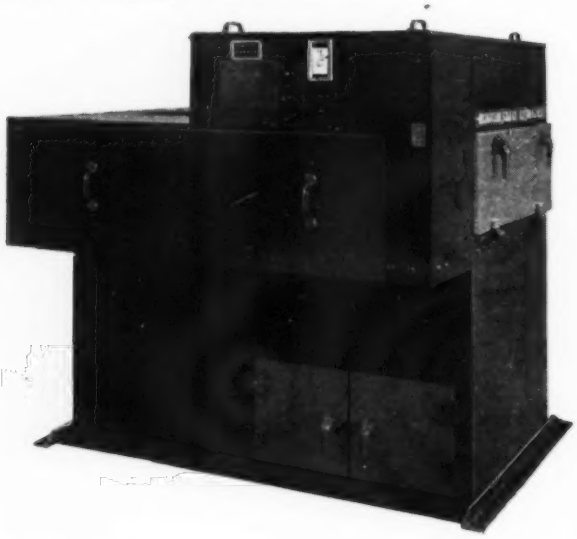


SHELL TURBO OIL
A name to Remember

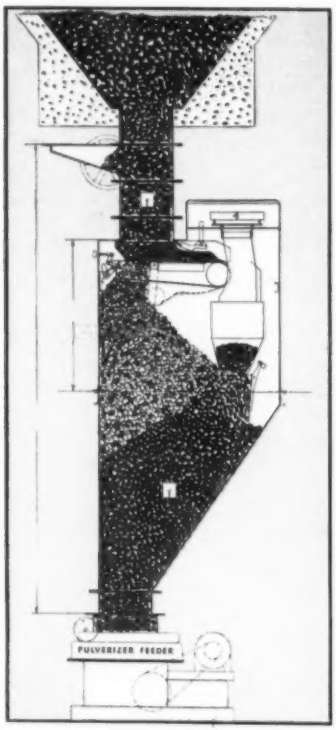
SHELL

RICHARDSON
COAL WEIGHING AND FEEDING SYSTEM

Gives accurate record of fuel consumption by each boiler and helps you get maximum evaporation from each pound of coal.



Richardson furnishes complete systems from bunker to pulverizer or stoker—bunker gates, spouts, Automatic Coal Scales and conveying systems to suit existing and new plants, and MONORATE Non-Segregating Stoker Distributors.



✦ **1889** ✦
Automatic Scales

✦ **1910** ✦
Automatic Scales for Coal

✦ **1922** ✦
Automatic Scales for Coal (Belt Feeder Invented)

✦ **1935** ✦
Automatic Scales for Coal (Electric Model, ¼% Accuracy)

✦ **1941** ✦
Automatic Scales for Coal (Streamline Model)

50 Years' Experience for Sale

RICHARDSON SCALE COMPANY
CLIFTON, NEW JERSEY

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training and practical production experience. Pre-employment and supplemental training courses are provided by vocational schools and colleges under auspices of the United States Office of Education.

Mr McNutt's remarks were based on a year-end report by William F Patterson, Director of the Apprentice and Training Service, summarizing the accomplishments of the agency in short-term training and apprenticeship up to December 15.

The report shows that in December, 29,291 firms had short-term "advancing worker" and apprenticeship programs in operation formulated with the help of the Service. A compilation made last February showed that at that time there were 18,500 companies training under ATS programs, indicating an increase of nearly 11,000 in less than ten full months.

Though it is not indicated in the report what proportion of the program organized between February and December, involved "advancing worker" training, the Services' interest in short-term training dates from August 1941, when minimum standards covering all types of short-term in-plant training were developed and approved by the Federal Committee on Apprenticeship.

The report reveals that during the sixteen months since September 1941, when the Service began to put short-term training standards in operation, a total of 328 "advancing worker" programs have been completed, an average of 20 each month. Of this number, 198 have been set up in conjunction with apprenticeship programs, thus assuring the plants full coverage of labor needs in all categories of skill.

Approximately 7,292,000 workers are employed by the 29,291 companies serviced by the Apprentice and Training Service. Included in this number are 127,230 apprentices.

It has been repeatedly pointed out by the War Manpower Commission that there are no more unemployed skilled workers and that, to utilize fully the manpower on hand, plants must make arrangements for a continuous and comprehensive program of in-plant training for new workers.

By these arrangements not only can the skills of green workers be developed more quickly but the skills of workers now on the job can be further developed through upgrading and short-term training, and apprenticeship.

Field representatives of the Apprentice and Training Service are located in or near key industrial areas, and can be reached through the nearest War Manpower Commission field office.

NO PRIORITIES NEEDED...

FOR MAXIM ENGINEERING SERVICE

Maxim Silencers, Spark Arrestors and Combination Waste Heat Boiler-Silencer units are available only on high priority ratings because Maxim's total capacity must be directed toward essential war production.

Some who cannot secure these ratings, however, have problems pertaining to the operation and efficiency of their engines, and in many cases Maxim engineers can help solve these problems. In some, a simple adjustment of exhaust pipe length may be the answer . . . in others, present silencing equipment (built in your own plant, perhaps) can be improved.

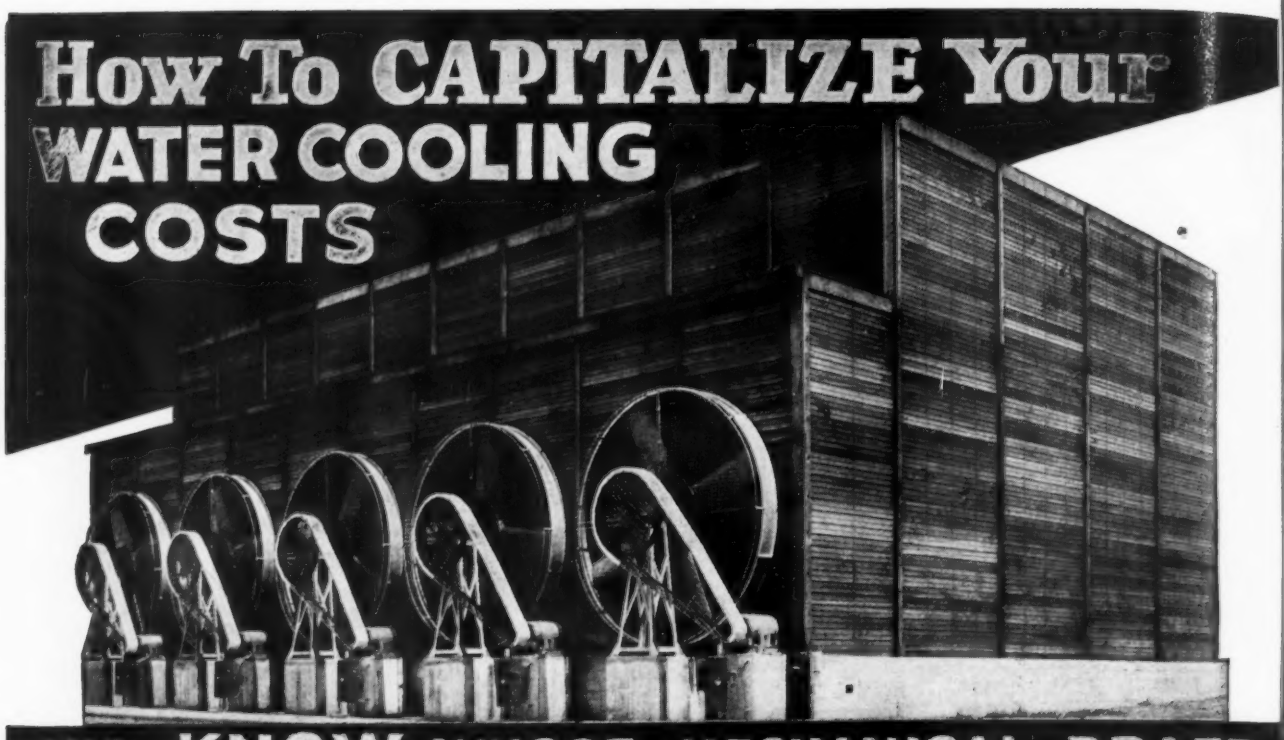
Write to Maxim giving complete engine specifications together with a sketch of your present hook-up, describing in detail your exhaust and intake piping arrangement and what your particular difficulty seems to be. Maxim engineers will be glad to help you WITHOUT PRIORITY and without obligation.

THE MAXIM SILENCER COMPANY
92 Homestead Ave. Hartford, Conn.

MAXIM

WARTIME ENGINEERING SERVICE

How To CAPITALIZE Your WATER COOLING COSTS



AND KNOW WHOSE MECHANICAL DRAFT EQUIPMENT WILL SAVE YOU MOST . . .

Why Pritchard Towers Save You Money

1. Low Pumping Head. Closed pipe water distribution through gravity sprinklers cuts down frictional resistance; saves pump power for lifting; sometimes even permits building higher towers without waste.

2. Liberal Size and Rating. Any "skimping" on capacity must be made up by an extra load on fans or tower efficiency will suffer. Pritchard towers are sized and rated to permit low air velocities and consequent lighter fan loads.

3. High Efficiency, Light Weight, Non-Corrosive Monel Fans. Pritchard fans are the heart of Pritchard tower efficiency and economy. Their superior design and construction saves tremendous amounts of horse power over a period of years. Blades have a special twist and taper that gives a steady, uniform air flow through the entire fan opening.

The use of non-corrosive sheet monel over a light, strong framework cuts weight to half that of cast alloy—ends corrosion and pitting troubles. Larger blades, and often fewer of them, move the required volume of air with less fan speed and less fan power. Pritchard fan drive design and fan housing design, particularly in induced draft towers, contribute further to fan efficiency and horsepower economy.

Further details on request. Write for them.

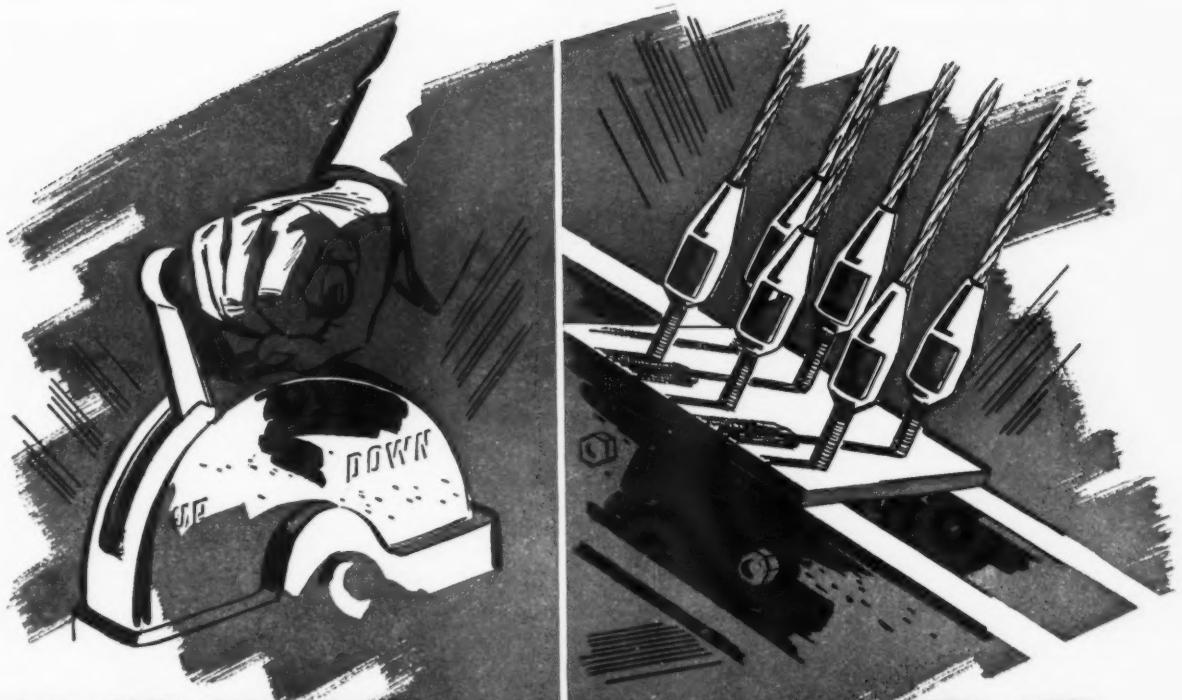
On the basis of 1¢ per kilowat hour, 24 hours per day, 250 days per year, the cost of operating a mechanical draft tower for 5 years is $300 per horsepower. Add to this the cost of your tower and you have your total 5-year cost, exclusive of upkeep.

Pritchard welcomes and urges this method of purchase because almost invariably Pritchard towers capitalize out at lower cost.

There are several reasons why—the most important of which are described in the column to the left. Read these reasons carefully. File them for future reference if you will. And be sure to get definite cost capitalization figures from Pritchard—and from any others you may choose—on the next mechanical draft tower you buy.

J. F. PRITCHARD and COMPANY
FIDELITY BUILDING KANSAS CITY, MO.
Branch Offices in Tulsa, Okla.; Houston, Texas; Atlanta, Ga.
Chicago, Ill.; Pittsburgh, Pa.; New York City

PRITCHARD
Atmospheric and Mechanical Draft
WATER COOLING TOWERS



HERE . . . and HERE

Two Places WHERE YOU CAN HELP BEAT THE AXIS SOONER

By keeping elevator cables on the job for the duration, you can help save a lot of steel and release a lot of wire rope for war duty with our fighting forces.

Here are the two places to do it:

FIRST: at the car controls. Be sure your operators run their cars *correctly,* starting and stopping smoothly, accelerating slowly, leveling properly the *first* time they stop at a floor.

SECOND: on the cables themselves. Be sure cables are correctly installed, that yourservice men regularly lubricate them, consistently check and adjust them, if necessary, for even tension. Put into action a *calendar* of inspection and maintenance for your service people to follow, covering not only the cables themselves, but cable fastenings, sheaves and other fittings.

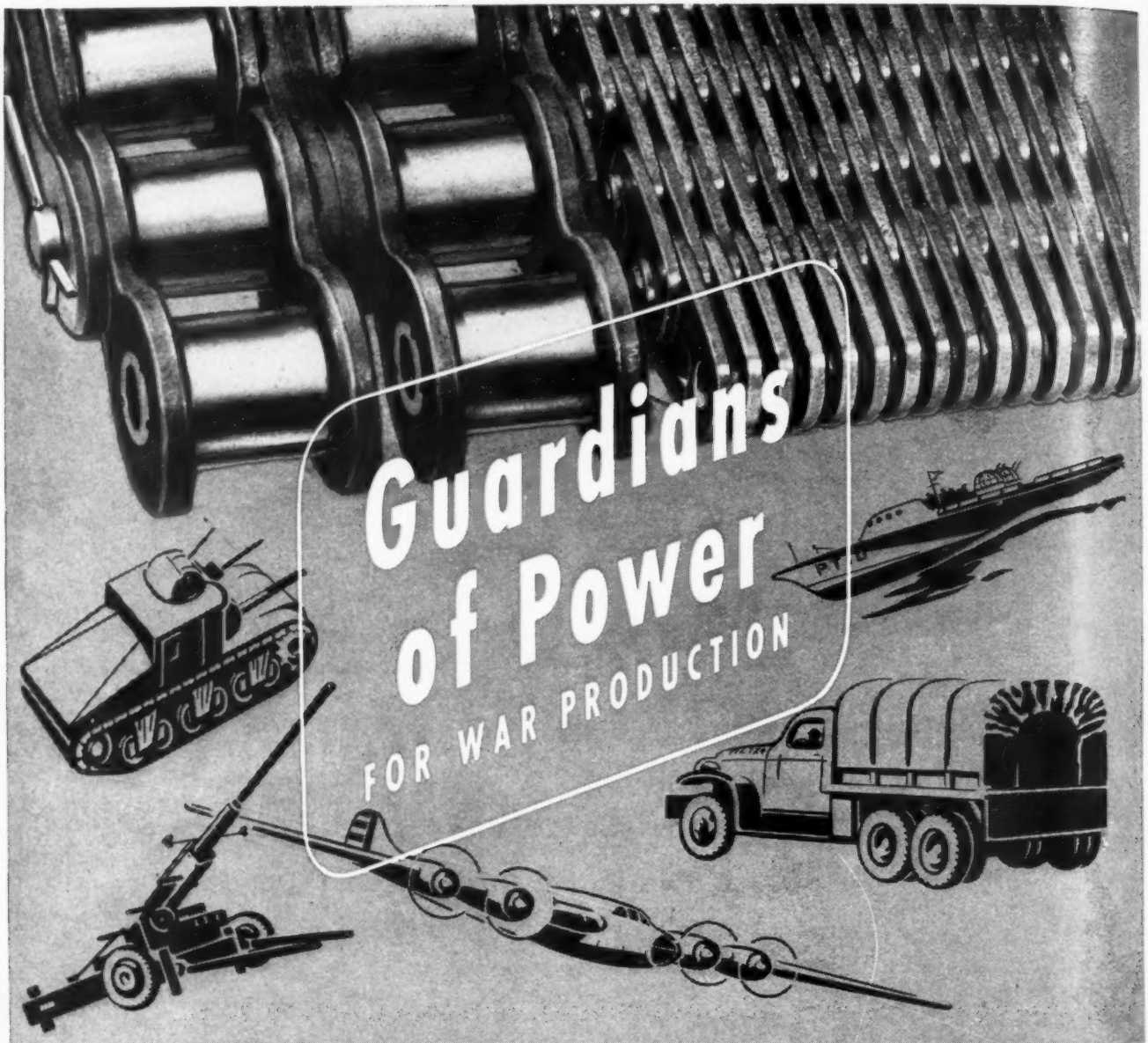
In the car or on the cables, remember that your job is one of *war transportation,* and that the steel you save will be a heaven-sent gift to the boys at the fighting fronts.

JOHN A. ROEBLING'S SONS COMPANY
TRENTON, NEW JERSEY
Branches and Warehouses in Principal Cities

HERE'S THE HANDY ROEBLING ELEVATOR ROPE CONSERVATION TAG—a ready reference on wire rope care for your maintenance men. Ask for your supply of Tag "C".

★ PROMPT SERVICE
★ on essential orders
from warehouse
★ stocks or mill

ROEBLING
"Traction Steel"
ELEVATOR ROPE



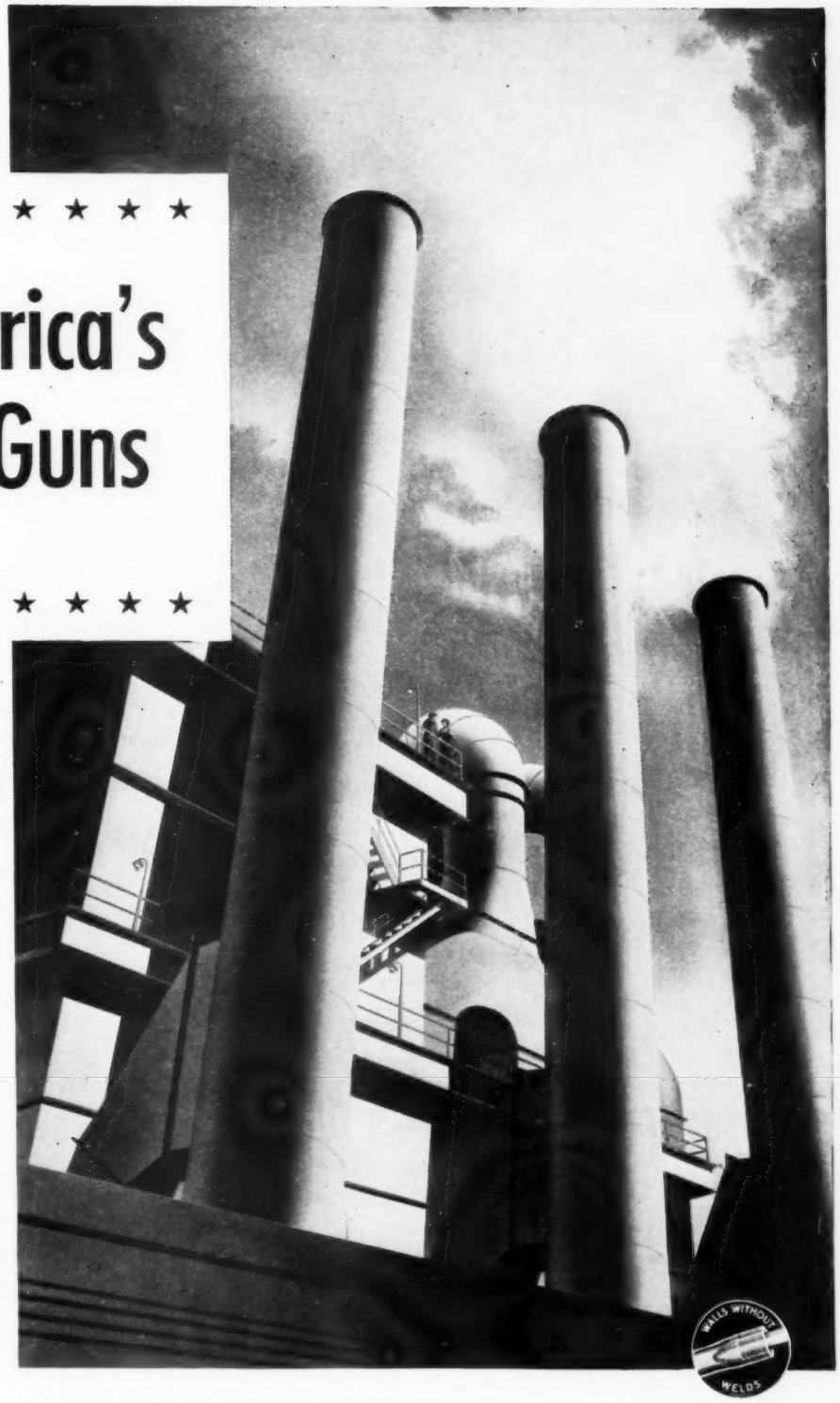
To maintain peak war production, you need efficient transmission of power. Virtually, Morse Silent and Roller Chain Drives are guardians of power—a positive safeguard against creep, chatter, slippage and waste. Regardless of speeds, overloads, shocks, or elements, Morse Chain Drives deliver full power constantly at high efficiency. Maintenance is practically non-existent. Morse Representatives are ready to help you in your war production with chain drives engineered to the job.

SILENT CHAINS ROLLER CHAINS FLEXIBLE COUPLINGS CLUTCHES

MORSE *positive* DRIVES

MORSE CHAIN COMPANY ITHACA N. Y. DIVISION BORG-WARNER CORP.

Firing America's "Biggest" Guns



NO other guns are more important than the smokestacks of industry. Behind each one is hidden the pool of power that helps make America strong. New war plants have strained the capacity of public utilities, and increasing loads have been thrown on industrial power plants.

While better boiler design and other improved plant equipment are playing an important part in keeping boilers on the job, the major responsibility for continuous operation rests upon the boiler tube. Today, boiler tubes are "more precious than gold" . . . and the plant equipped with NATIONAL Seamless Tubes has a better chance to stand up as the going gets tougher. Why is this true? Because seamless tubes have uniform wall strength throughout. There's no weld or potential source of weakness. Each tube is pierced from the highest quality killed open hearth steel—one homogeneous cylinder, absolutely Walls Without Welds.

In the Nation's leading power plants NATIONAL Tubes are serving for one dominant consideration — maximum production for our fighting forces.

All in all, America's power plants and the men who operate them are doing a grand job in the War Program. They are the mighty force that keep the wheels of industry running—they fire America's "Biggest Guns." Congratulations to Uncle Sam's power industry.

NATIONAL TUBE COMPANY

PITTSBURGH, PA.

Columbia Steel Company, San Francisco, *Pacific Coast Distributors* · United States Steel Export Company, New York

UNITED STATES STEEL

COTTRELL PROCESS

of

ELECTRICAL PRECIPITATION

universally recognized as a
standard method of removing

DUST, FLY ASH, FUME, MIST & FOG

***from* GASES**

•

30 years of research development and operating experience throughout the world is incorporated in the

COTTRELL INSTALLATIONS

offered to meet the requirements
of any problem by

RESEARCH CORPORATION

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NEW YORK CITY

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Maritime Commission "M"
awarded to
THE M. W. KELLOGG COMPANY

Dedicated to the Men of the Merchant Marine, Guardians of the Life-line between all the United Nations.

HEAT TRANSFER DIVISION

THE M. W. KELLOGG COMPANY

225 BROADWAY, N. Y. • **JERSEY CITY, N. J.**

New Power Unit Broadens Scope of Climax Engineering Company

YOU KNOW CLIMAX as the manufacturer of Blue Streak Gas Engines for oil industry, factory and engineering contractors; as the company that built the first successful gasoline engine for heavy duty cranes; and constructed engines so well that after almost 30 years of operation some of the first ones made are still in service.

WHEREVER SELF-CONTAINED POWER UNITS ARE NEEDED you are likely to find a Climax. Throughout America, in foreign towns and cities, and in remote, far-flung corners of the earth, Climax engines are delivering dependable power with a variety of local fuels and unskilled native supervision.

The first Climax engines were designed for service on tractors. They were so successful for this work that standard units and accessories were made to drive oil field equipment, power shovels, cranes, hoists, locomotives, snow plows, and for stationary service-pumping, electric power generation, etc. Then came increased demands for larger engines and higher speed units to meet modern demands for faster operating machinery.

Perhaps as well known as Climax Gas Engines are Climax Generating Sets—the outcome of a long uninterrupted program of product development. Through the years, as these sets became known, they have served an ever widening market. Prior to the present war, the majority of Climax Generating Sets were installed for emergency or stand-by service. For this work the sets carried a general guarantee to start and be on full load—automatically—within fifteen (15) seconds from the instant of outside power failure.

A count of Climax installations for power service includes practically every type of commercial, industrial and federal project. Included in the list are generating sets for public, office and store buildings, banks, warehouses, packing and processing plants, factories, hospitals, churches, terminals for airways, railroads, bus stations, jails, sewage plants, radio stations, theatres, camps, armories, arsenals, etc.

The new Climax V-12 is the latest addition to the line of Blue Streak power units. Strong as the originals, plus the addition of every new and proved technical improvement, it is the answer to your war demands for a high speed unit to step up power output and reduce down time.

And these are not the V-12's only assets.

Because it is built to stand the punishment of heavy duty service in engineering construction, oil fields and industrial plants, V-12 is a sound investment for your postwar production. Get the full details today by writing to Dept. P, Climax Engineering Company, Clinton, Iowa.

ANNOUNCING TO ENGINE BUYERS

Easy Starting...Smooth Running and Abundant Power

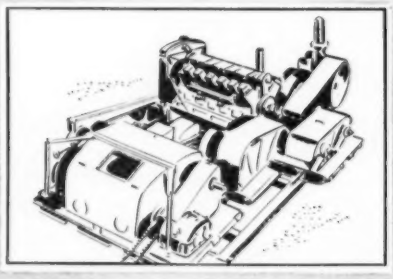
...are the three outstanding attributes of the new Climax V-12 Engine. These features make it an ideal power unit for deep well oil drilling, pumping, stationary power and construction applications. From the standpoint of design, construction and operation, this new engine has everything that technical ability and long experience can contribute.

The simple, well balanced design promotes high mechanical efficiency. The heavy reinforced construction gives the user many years of profitable and continuous service with negligible maintenance cost. Of particular value is the fact that the V-12 can be maintained by regular field or shop men *without the need for specialized training*.

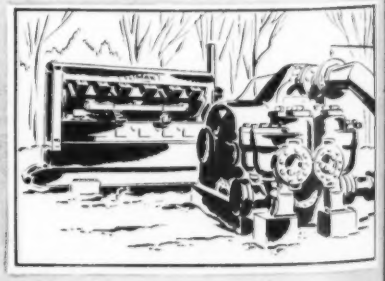
The V-12 also meets today's demands for a higher speed engine which will mesh with modern power consuming machinery. The normal speed range of this engine is from 600 r.p.m. to 1200 r.p.m. for either continuous or intermittent service.

Get all details now on how this new Climax unit can meet your individual needs. Complete information will be furnished by writing to Dept. P, Climax Engineering Company, Clinton, Iowa.

V-12 IS A GENERAL PURPOSE PRIME MOVER WHICH DELIVERS PEAK



1—For deep oil well drilling



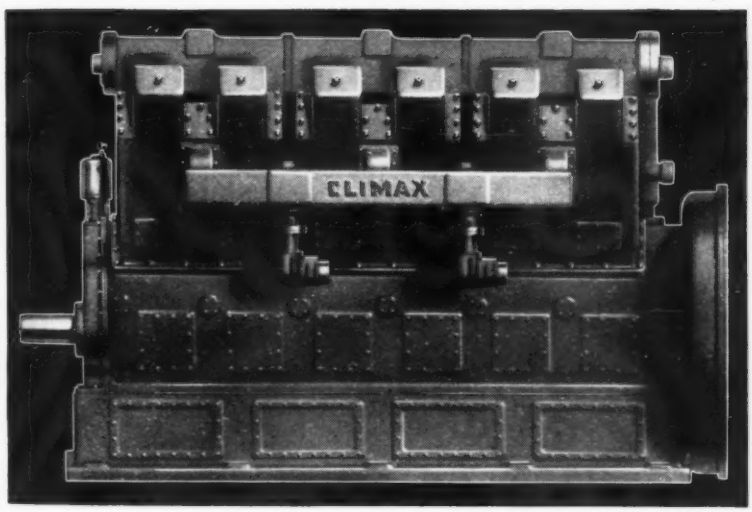
2—Driving pumps and compressors

...the NEW

Climax

Blue Streak V-12 ENGINE

for operation on gasoline, natural gas, butane, sewage gas and other fuels



FACTS

FOR THE MEN WHO MAKE DECISIONS

TYPE AND SIZE

A 12-cylinder "V" type engine available in two bores—Model V-335, 6½" bore and 7" stroke; Model V-390, 7" bore and 7" stroke.

ENGINE PERFORMANCE

Power Generating Capacity:
V-335 (6½" bore) develops 375 hp. at 1200 r.p.m.
V-390 (7" bore) develops 435 hp. at 1200 r.p.m.

FUEL RANGE AND REQUIREMENTS

Both models operate with equal facility on gasoline, natural gas, butane, sewage gas and other fuels. Fuel requirements are low, and the engines will deliver highest power output possible for the fuel used.

FEATURES OF DESIGN AND CONSTRUCTION

1—COMPACTNESS AND ACCESSIBILITY—The "V" type engine permits lightest weight with shorter overall length. Easier maintenance and servicing are made possible by the outside location of all accessories.

2—HIGH MECHANICAL EFFICIENCY—Balanced design, dual ignition and water-cooled manifolding result in peak mechanical efficiency for the new V-12.

3—DUAL IGNITION—V-12 can be furnished in the following combinations of dual ignition:

a — Dual battery ignition.
b — Dual magneto ignition.
c — Battery and magneto ignition.

Each cylinder has two spark plugs. These two plugs provide a greater flame; and shut down due to ignition failure is practically eliminated. Should one plug fail, the other will continue to operate without impairing the performance of the engine.

4—WATER-COOLED MANIFOLD is designed to attain uniform quality of gas mixtures. It is located between and above cylinder blocks with all turns and bends reduced to a minimum.

5—CYLINDER BLOCKS CAST IN PAIRS from close-grained cast iron designed with an ample factor of safety to take the stresses encountered under all operating conditions.

6—AMPLE COOLING SURFACES—Wide spaced, large capacity water jackets cover entire length of stroke. This results in equal expansion of cylinder bores.

7—WET CYLINDER SLEEVES—Promote long life, simplify maintenance and add to economy of operation.

8—SEVEN BEARING CRANKSHAFT is carried in precision type, steel back babbitt-lined bearings. These are rigidly supported by heavy ribbed and flanged housing members.

9—ALUMINUM PISTONS are of heavy ribbed construction fitted with five rings, and full floating piston pins. Sealed compression is attained by locating four rings above piston pins and one ring below.

10—CONNECTING RODS are rifle drilled from drop-forged, heat-treated steel. The large ends are machined to receive replaceable precision bushings.

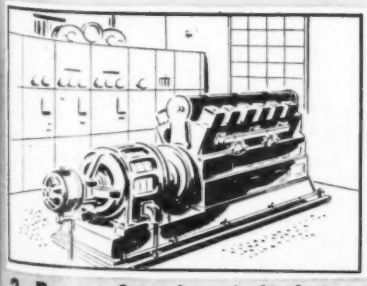
11—OVERHEAD VALVES with inserted valve seats and fully enclosed push rods promote high operating efficiency and protection against harmful atmospheric effects.

12—DUAL CARBURETOR FLEXIBILITY—Optimum performance under a wide variety of operating conditions is made possible by the dual carburetors on each bank of cylinders. In operation they compensate one another and give precise mixtures as required.

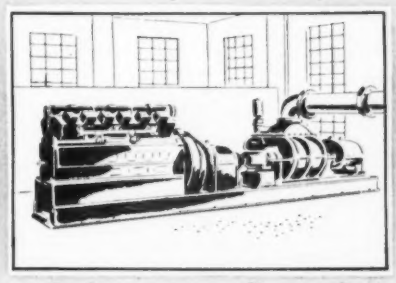
ACCESSORY EQUIPMENT FOR HE V-12 ENGINE

Where required, Climax furnishes a complete range of accessory equipment such as starting devices, air cleaners, filters, radiators, heat exchangers, etc. All of this may be selected to meet the specific needs of the engine application.

PERFORMANCE IN THE 375 h.p. AND 435 h.p. RANGE FOR THE FOLLOWING SERVICES:



3—Power for electric lighting and power plants



4—In sewage disposal plants

Climax Engineering Company

GENERAL OFFICES & FACTORY:
CLINTON, IOWA
REGIONAL OFFICE: DALLAS, TEXAS

General View of Machine Shop — Bay No. 1

ALCO

ENGINEERS and MANUFACTURERS

HEAT EXCHANGERS
PRESSURE VESSELS
PRE-FABRICATED PIPING

Our Facilities are Producing Essential Equipment First . . .

Write for listing of products — BULLETIN No. 1030

AMERICAN LOCOMOTIVE COMPANY
ALCO PRODUCTS DIVISION
30 CHURCH ST., NEW YORK, N. Y. **DUNKIRK, N. Y.**

Let a Square D Field Engineer Help You

They get around, these Square D Field Engineers. They're digging into wartime electrical control and distribution problems every day—working with plants of *every size and kind.* They study methods and applications with the idea of simplifying new jobs or doing old ones better. That is vitally important work during these days when the production front is facing its greatest test. It is equally important in planning now for speedy conversion the day peace comes.

If you have a problem involving electrical control or distribution, call in the nearest Square D Field Engineer. Backing him up in every Square D plant, are design and engineering specialists with complete research and testing laboratories at their command.

There are Field Engineers in Square D branch offices in 52 principal United States and Canadian cities. Their services are dedicated to solving industry's war and post-war electrical problems.

Wherever Electricity is Controlled or Distributed

SAFETY SWITCHES ★ CIRCUIT BREAKERS ★ MOTOR CONTROL
★ SWITCHBOARDS ★ SQUARE DUCT ★ PRESSURE SWITCHES
★ PANELBOARDS ★ MULTI-BREAKERS ★ WELDING CONTROL
MILITARY ★ AIRCRAFT ★ MARINE ELECTRICAL CONTROL

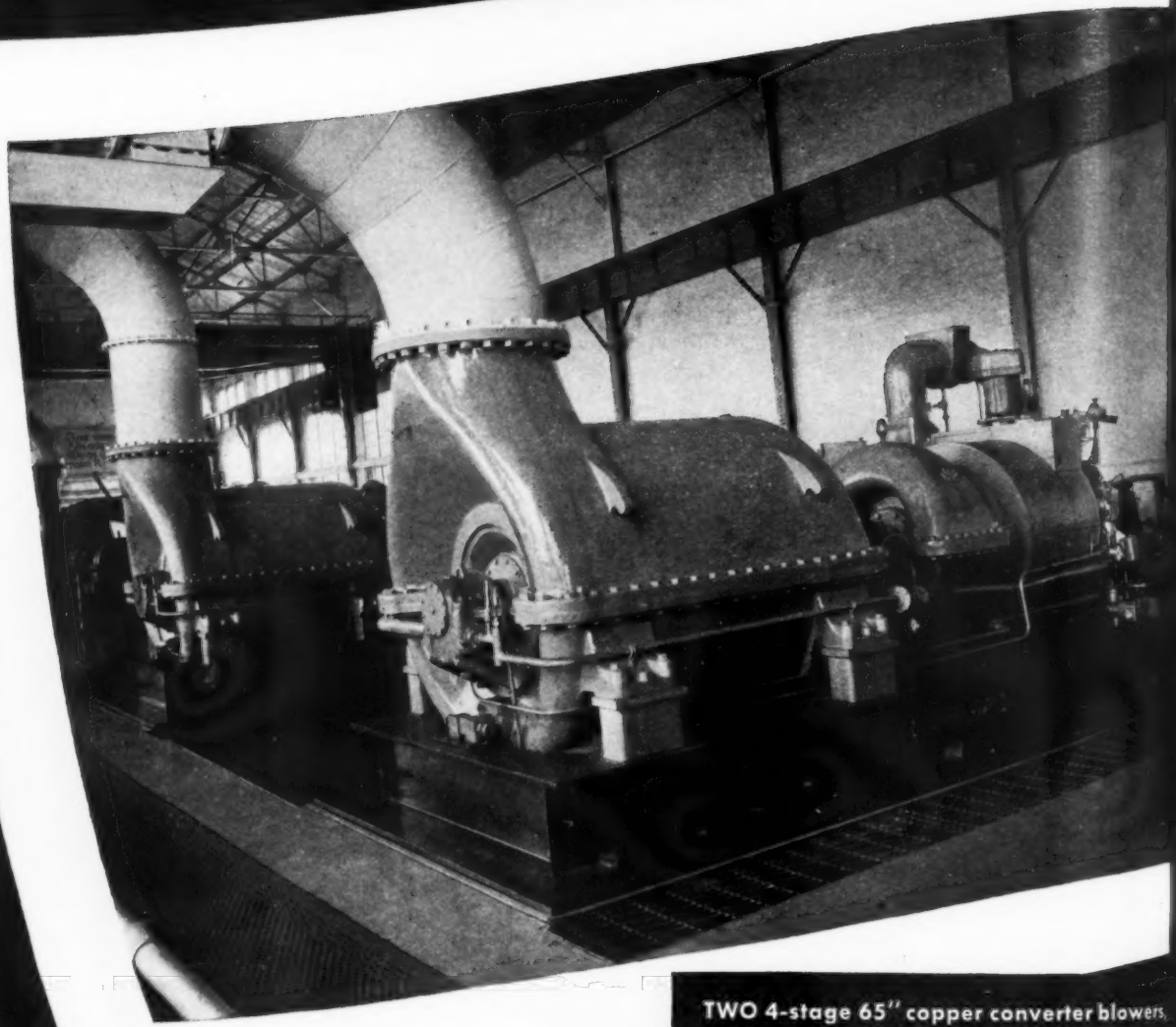
SQUARE D COMPANY

DETROIT - MILWAUKEE - LOS ANGELES

KOLLSMAN INSTRUMENT DIVISION, ELMHURST, NEW YORK

IN CANADA: SQUARE D COMPANY CANADA LIMITED, TORONTO, ONTARIO

CONSTANT TURBINE S



TWO 4-stage 65" copper converter blowers, each rated at 25,000 c.f.m., 18 lbs. pressure, driven by G-E turbines at the plant of a large copper company in the Middle West.

TEXACO

REG. T. M.

TEXACO

TUNE IN FRED ALLEN EVERY SUNDAY NIGHT—CBS

SPEED ASSURED . . .

YOU can be certain of constant turbine speed when governors are instantly responsive to each slight fluctuation of load . . . by lubricating with *Texaco Regal Oil.*

Texaco Regal Oils rapidly free themselves from air and water. In long years of service, in thousands of turbines, they have shown maximum resistance to oxidation, emulsification, gum formation and sludging. They keep circulating systems cleaner, governors sensitive, bearing temperatures normal.

The outstanding performance that has made Texaco preferred in the fields listed below has made it preferred by prominent turbine operators everywhere.

These Texaco users enjoy many benefits that can also be yours. A Texaco Lubrication Engineer will gladly cooperate in the selection of the most suitable lubricants for your equipment . . . just phone the nearest of more than 2300 Texaco distributing points in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York, N. Y.

THEY PREFER TEXACO

★ More buses, more bus lines and more bus-miles are lubricated with Texaco than with any other brand.

★ More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.

★ More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.

★ More locomotives and cars in the U. S. are lubricated with Texaco than with any other brand.

★ More revenue airline miles in the U. S. are flown with Texaco than with any other brand.

REGAL OILS

FOR ALL TURBINES

HELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY

BETTER LUBRICATION *with*

De Laval OIL PURIFIERS

THE De Laval Oil Purifier is the most effective means for keeping lubricating oil in circulatory systems of turbines and steam or oil engines free from all types of impurities which tend to lower its efficiency. When De Laval Oil Purifiers are operated on the continuous by-pass system, lubricating oil remains *at all times* free from impurities such as water, sludge, metallic particles, pipe scale and similar foreign matter—being kept, in fact, in a condition of purity only to be compared with that of new oil. Thus, bearings and other vital engine parts are constantly protected and more dependable power plant operation is secured.

Write *today* for illustrated Bulletin No. 106.

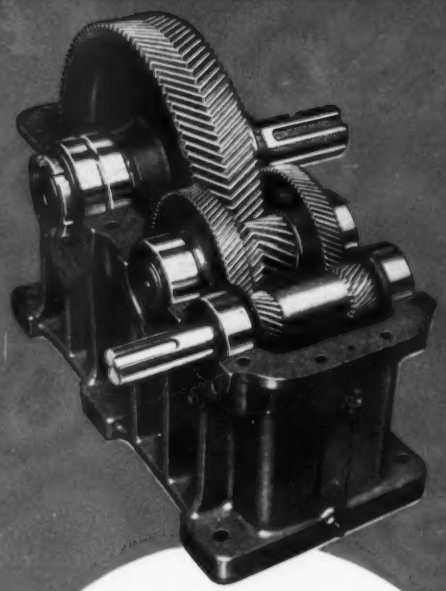
THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 427 Randolph St., Chicago
DE LAVAL PACIFIC COMPANY, 61 Beale St., San Francisco
THE DE LAVAL COMPANY, Limited
Montreal Peterborough Winnipeg Vancouver

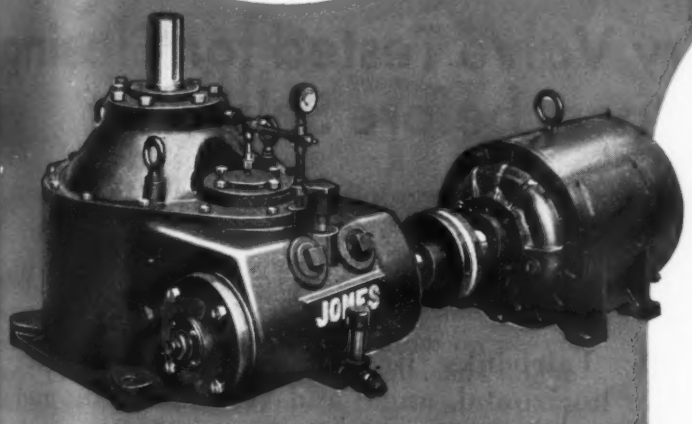
De Laval "UNI-MATIC" OIL PURIFIERS

To help you solve THE PRODUCTION PROBLEM

JONES WORM-HELICAL SPEED REDUCERS for vertical shaft drives

● These machines fill a long felt need for double reduction units of the fully enclosed type to be used for agitators, mixers, ore roasters, bending rolls, etc., requiring a vertical shaft drive. Built in standard ratios in various types of assemblies ranging from 40 to 1 to 250 to 1 for all common motor speeds and a wide range of horsepower ratings. Jones Bulletin No 75 covers complete details.





JONES HERRINGBONE SPEED REDUCERS

● Jones Herringbone Speed Reducers are built in single, double and triple reduction types with a large range of ratios and ratings making it possible to fulfill all ordinary requirements by the selection of standard units.

All these reducers have heat treated gears, ground shafts and are mounted with anti-friction bearings throughout.

Catalog No. 70 contains 128 pages of detailed information on the application of these speed reducers.

"JONES DRIVES FOR INDUSTRY"

is the title of a 16-page bulletin that may be helpful in giving you a broad picture of the Jones products, engineering services and manufacturing facilities that are available.

Just ask for Bulletin No. 80

W. A. JONES FOUNDRY & MACHINE CO.
4423 Roosevelt Road, Chicago, Illinois

Jones

HERRINGBONE — WORM — SPUR — GEAR SPEED REDUCERS • PULLEYS
CUT AND MOLDED TOOTH GEARS • V-BELT SHEAVES • ANTI-FRICTION
PILLOW BLOCKS • FRICTION CLUTCHES • TRANSMISSION APPLIANCES

YOU CAN BANK ON FAIRBANKS

for Bronze Check Valves

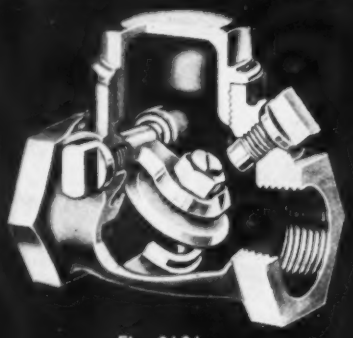


Fig. 0601

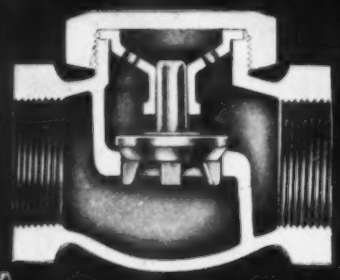


Fig. 0608

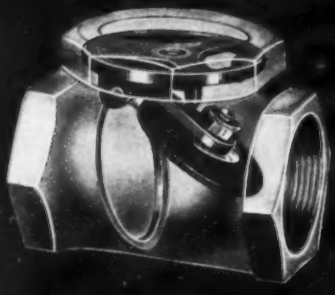


Fig. 0600

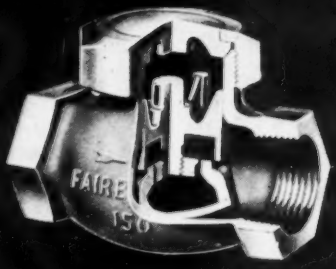


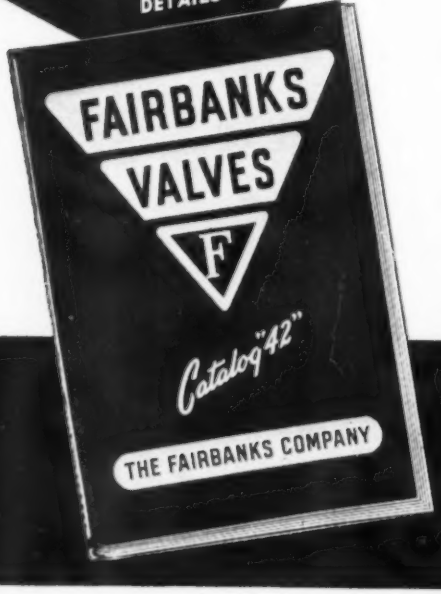
Fig. 0616

Fig. 0612

OTHER FAIRBANKS VALVES

Bronze Globe, Gate, Angle Cross and Check Valves
Iron Globe, Gate, Angle, Cross and Check Valves
Faircoseal Bronze Valves
U-Bolt Gate Valves
Asbestos Packed Cocks
Bronze Radiator Valves
Sphero Ball Valves

CONSULT FAIRBANKS NEW CATALOG No. 42 FOR DETAILS



Every Valve Tested for Closing Tightness before Shipment

SERVICE: Recommended for service on steam, water, gas or oil to prevent return flow. Available for steam workimg pressures from 125 to 350 lbs. at 700° F.

TYPES: Fairbanks Bronze Check Valves are made in horizontal, angle and vertical swing and lift types, with Renewable Bronze and Composition Discs.

FEATURES: These valves are of heavy construction, liberally proportioned and have large hexes with deep-cut pipe threads. The seat and disc can either be renewed when worn or easily reground, which greatly increases their life.

THE NEW AND COMPLETE FAIRBANKS CATALOG GIVES FULL DETAILS - SENT FREE ON REQUEST . . .

THE FAIRBANKS COMPANY

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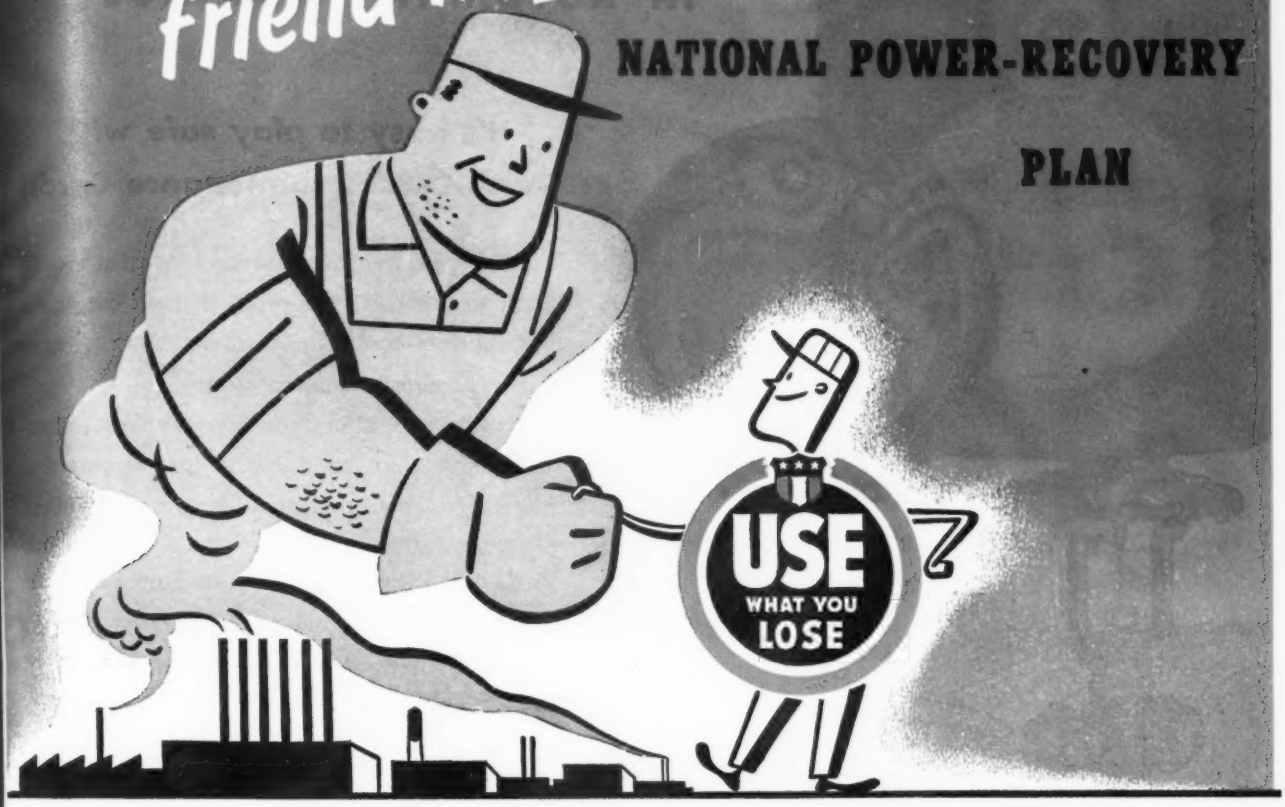
Distributors in Principal Cities

Industry's friend in need

THE Gilmer NATIONAL POWER-RECOVERY PLAN



Now, when Industry needs it most, the Gilmer National Power-Recovery Plan steps forward to increase available power by cutting down on power-waste. Practical Power-Recovery Estimators do the job... skillfully designed to meet the needs of these services: Electricity, Gas, Water, Steam, Mechanical Transmission, Compressed Air, Refrigeration, Boilers, and Prime Movers.

"*Two Boulder Dams Worth of Power*" are made available through the Gilmer Plan. If you want your share, then now is the time to put it to work. There's bound to be a spot in your plant where the FREE Gilmer Booklet and Charts can effect important and needed savings. Write to Gilmer today... no cost or obligation for this plan.

"This type of work is a genuine contribution to the war effort," Hoffman Beverage Company; "You have done a fine piece of work... made a substantial contribution to Power Conservation," Texas Power & Light Co.; "We feel this is a very good thing," The Celotex Corporation; "Want to congratulate you upon your National Power-Recovery Plan," Leeds & Northrup; "Well explained in the booklet," Johnson & Johnson.

AND HERE'S ADDED HELP FOR BELT PROBLEMS:

To help you choose the correct Gilmer Belt for every purpose, we offer the Gilmer Handy Belt Selector. It solves your needs at a glance, whether for V-Belts, Flat Belting, Round Endless Belts, Belts for Textile Machinery, or for special purposes. Write for it... today.

Gilmer BELTS

L. H. GILMER COMPANY
TACONY, PHILADELPHIA, PA.
The Oldest Firm of Rubber Belt Specialists

L. H. GILMER COMPANY
Tacony, Philadelphia, Pa.

Gentlemen: Please send me, without cost or obligation:

- ☐ The Gilmer National Power-Recovery Plan
- ☐ The Gilmer Handy Belt Selector

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COMPANY _____

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Why risk Interruptions

IN AUTOMATIC CONTROL?

It's easy to *play safe* with Quick-Check Maintenance Cards!

Have you ever considered what it would mean to operate your plant without automatic temperature controllers? More work . . . more waste . . . curtailments in output!

Foxboro now offers you an easy way to forestall neglect, or accidents to instruments that might necessitate such costly operation. Without charge, you may obtain Foxboro Quick-Check Cards outlining essential maintenance steps for each major type of instrument in your plant.

Attached to your installations or conveniently filed, these 9" x 11" Quick-Check Cards map out an easy routine that will keep instruments operating at top efficiency for the duration . . . save the uncertainties of wartime replacements or repairs . . . help to prevent interruptions in instrument performance. Equally useful for Foxboro or any other standard instruments.

Write us, specifying all different types of instruments you use. **The Foxboro Company, 68 Neponset Ave., Foxboro, Mass., U. S. A.** Branches in principal cities of U. S. and Canada.

* * *

This typical Quick-Check Card gives complete instructions "in a nutshell" for easy maintenance of Temperature Controllers and precision Control Valves of any standard make. Similar cards available for all major types of instruments.

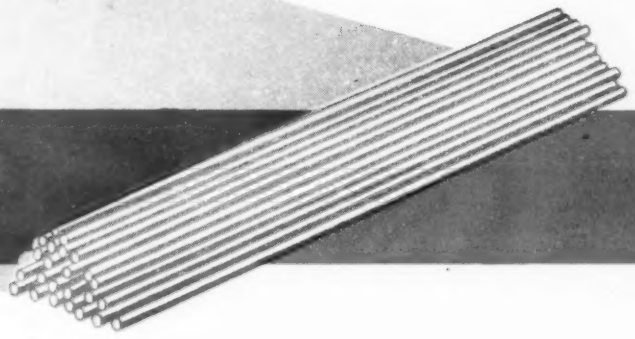
RECORDING • CONTROLLING • INDICATING

FOXBORO
REG. U. S. PAT. OFF.
Instruments

A NEW NAME AND PRODUCT THAT ARE WORTH-WHILE REMEMBERING!

Electroweld

PRESSURE AND MECHANICAL STEEL TUBING



Electroweld Steel Corporation manufactures pressure and mechanical tubing on one of the world's most modern and up-to-date mills. Electroweld's excellent production facilities, plus scrupulous care by skilled workmen during each operation, give you assurance that every length of tubing is uniform and has important high qualities. Electroweld tubing, therefore, provides noteworthy performance in heat exchange, refrigeration, and condenser equipment. It is outstanding for mechanical applications. Uniform diameter, uniform wall thickness, uniformity of structure in the weld area, plus square and uniform cuts permit savings of real importance.

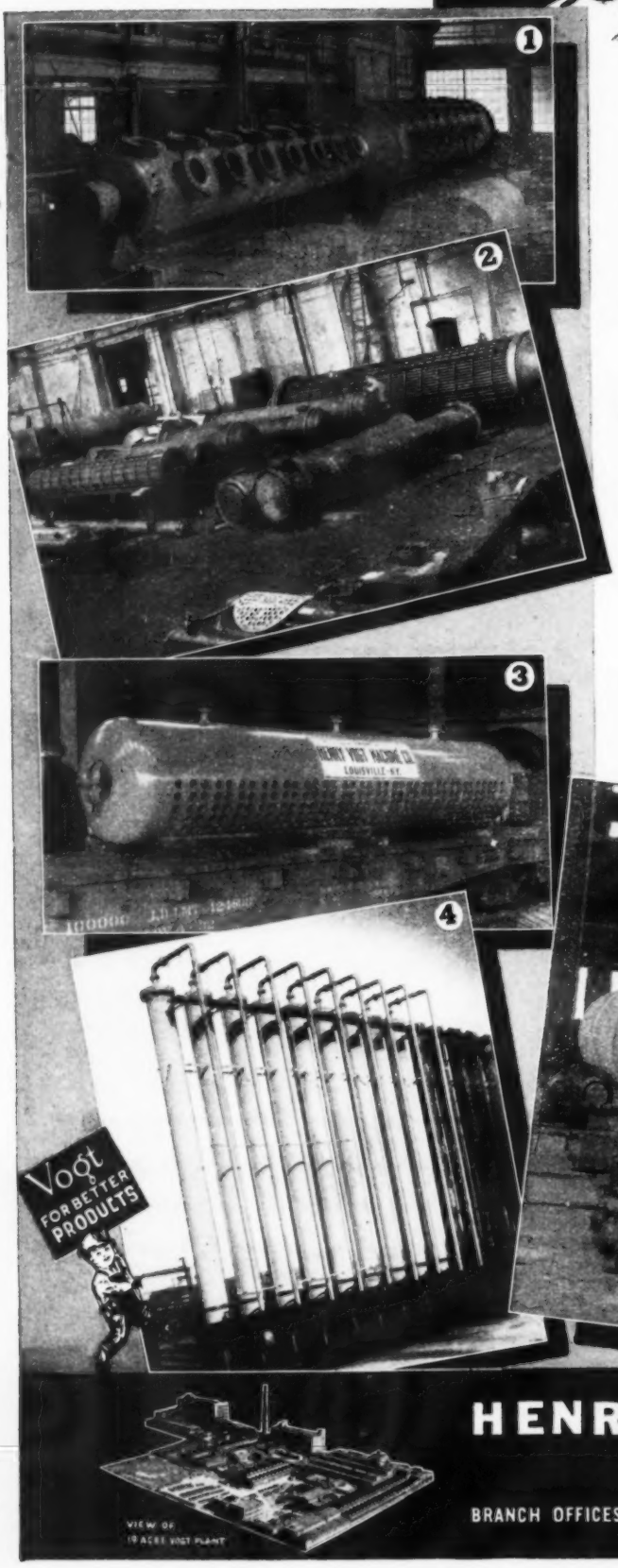
Electroweld Steel Corporation has a large capacity devoted entirely to the war effort . . . Another mill, now under construction, will increase greatly Electroweld production. When victory be ours, we believe that this excellent product will prove advantageous in your peacetime operations.

Electroweld
Reg. U.S. Pat. Off.

Electroweld STEEL CORPORATION · OIL CITY · PENNA.

A.P.I.—A.S.M.E. and A.S.M.E. CODES • CARBON STEEL AND SPECIAL STEEL

WELDED PRODUCTS by Vogt



1 – 4′—0″ dia. x 7′—6″ dia. x 82′—5″ high Stabilizer Tower for a Texas Refinery. Fabricated to A.P.I.-A.S.M.E. Code, stress relieved and X-rayed. 250# working pressure.

2 – Heat Exchangers, for an Eastern Refinery, on the testing floor. Units have fusion welded Monel Metal shells and were built to customer's specifications.

3 – 48″ dia. x 22′—6″ long mud drum for a Vogt Water Tube Boiler designed to operate at 450# S.W.P. Fusion welded to A.S.M.E. Boiler Code.

4 – Battery of Absorption Columns in a Western Refinery. Units are 33″ dia. x 41′—0″ high and were stress relieved after welding.

5 – 400 KV Industrial X-ray unit in our plate welding department. Exographs of welded seams can be quickly made because of the special motor operated rolls and traveling carriages which are adjustable to vessels of any size.

VIEW OF 10 ACRE VOGT PLANT

HENRY VOGT MACHINE CO.

Incorporated

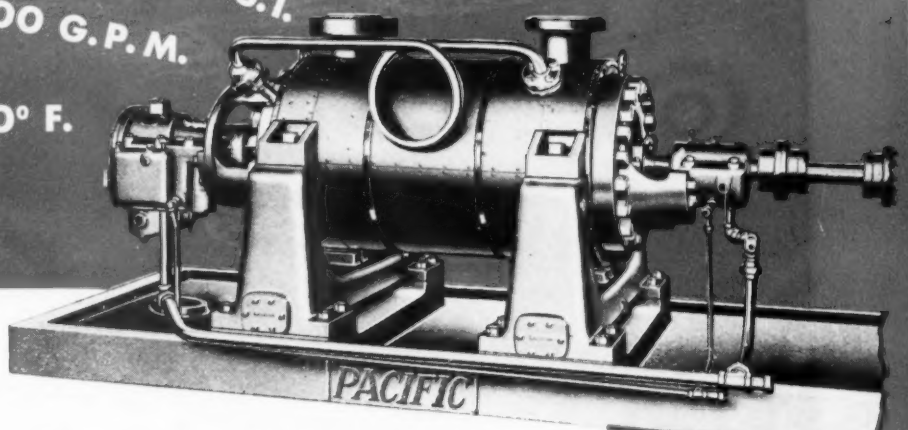
LOUISVILLE, KENTUCKY

BRANCH OFFICES: NEW YORK - PHILADELPHIA - CLEVELAND - CHICAGO - DALLAS

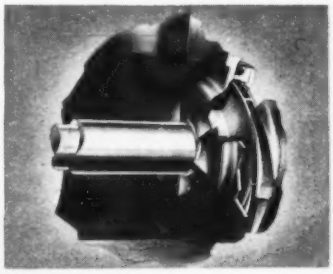
DIFFERENTIAL PRESSURES up to 2500 P.S.I.

CAPACITIES from 100 to 2700 G.P.M.

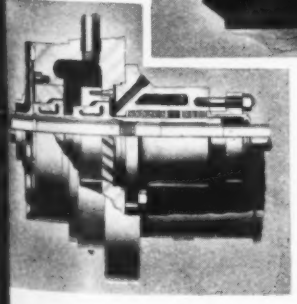
TEMPERATURES up to 850° F.



These are the Range of Operating Conditions under which PACIFIC BOILER FEED PUMPS are delivering lasting, trouble-free service



View of first-stage impeller showing how mixed flow impeller vanes extend out into the suction eye. Low suction velocities are obtained through the design of the large suction bay and large area of first-stage impeller.



Arrangement of balanced, stationary, floating seals for reducing high suction pressure on pump packing and balancing pump thrust. Parts are corrosion proof and the sealing faces are hard faced.

WHEN you buy or specify Pacific Pumps you are interested in *one* thing—pushing through fluid under the conditions which prevail in *your* plant. You aren't buying merely steel, valves, pipes, stuffing boxes, shafts or suction chambers. You are buying *pumping service.*

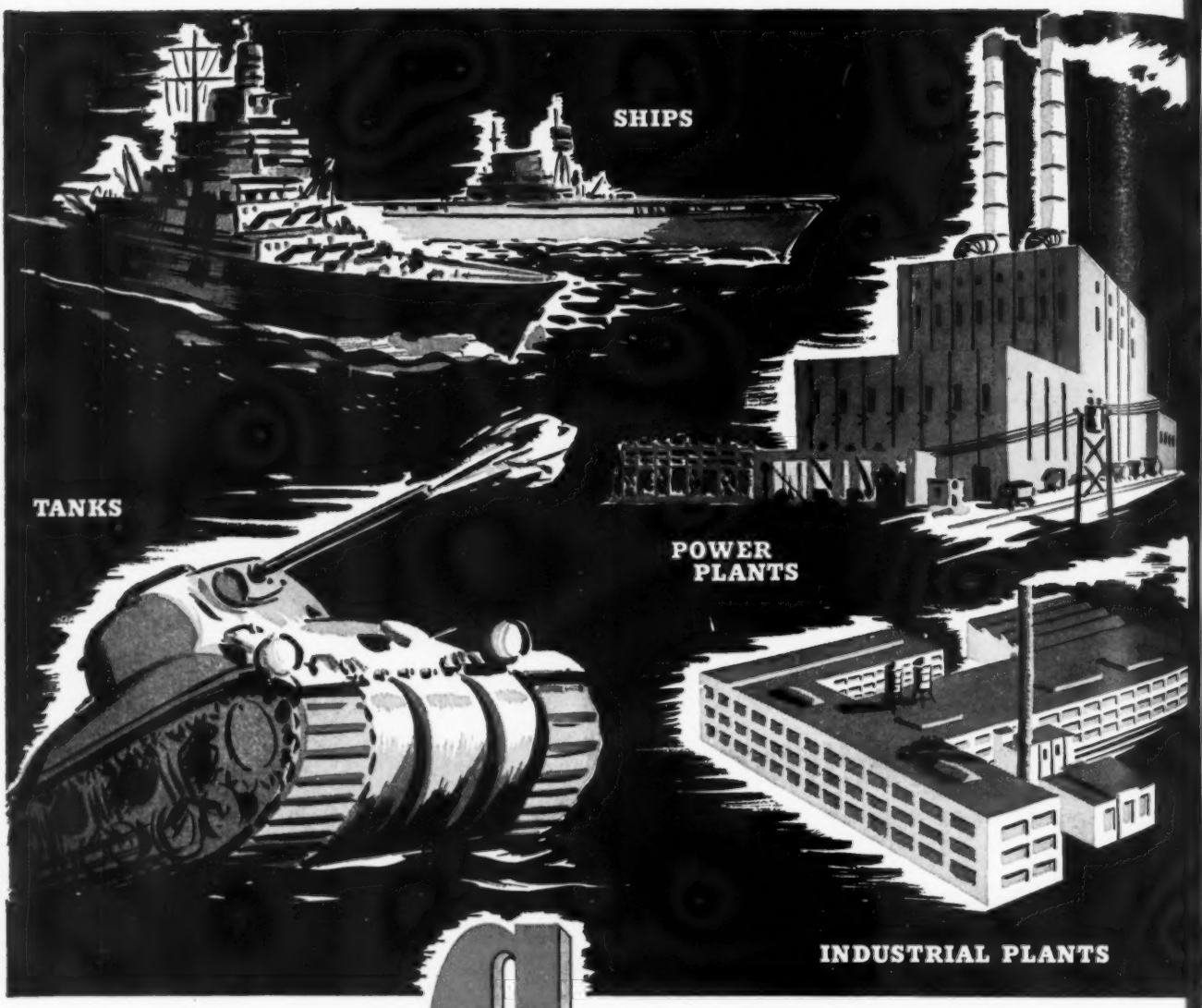
You might be interested in the special, patented design features, the unusual seal arrangements, the high quality of hardened metal used in Pacific Pumps. You may even like to know about their corrosion-resisting abilities, too. Fundamentally, however, you want to know that in your plant fluids will come and fluids will go—but your Pacific Pumps will go on—literally forever... delivering lasting, trouble-free service.

PACIFIC PUMP WORKS

Executive Offices and Plant: Huntington Park, California
Export Office: 30 Rockefeller Plaza, New York • *Sales and Service:* Offices in Principal Cities in the United States

PACIFIC *Engineered* PUMPS

FOR BOILER FEED WATER SERVICE



GET HELP FROM CLARAGE IN MEETING VITAL AIR-HANDLING APPLICATIONS

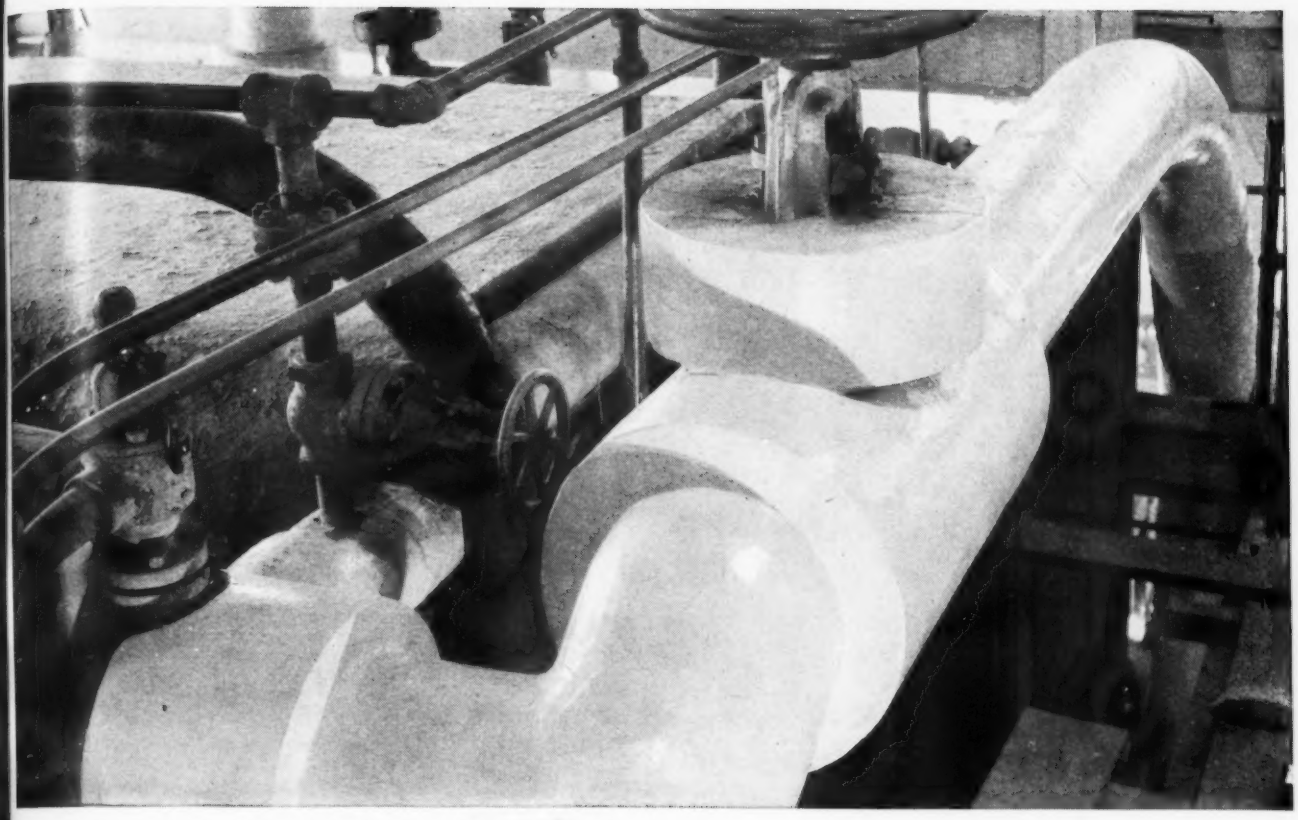
For more than a quarter-century the name "Clarage" has meant top quality in air-handling equipment designed for all types of industrial purposes, and power plant mechanical draft. Clarage still serves these essential fields. However, we now are doing more than that! Today, the skill and experience of this organization is utilized by our Government and by private builders in solving ship ventilation, tank cooling and many other special fan and blower problems pertinent to war.

We say this to let you know that our present facilities are adequate. Whatever your war time air-handling requirements, Clarage can give you the kind of service vour urgent needs demand.

COMPLETE AIR CONDITIONING
•
COOLING
•
VENTILATION
•
FACTORY HEATING
•
MECHANICAL DRAFT
•
FANS and BLOWERS for INDUSTRIAL NEEDS

Clarage Fan Company Kalamazoo, Mich.

APPLICATION ENGINEERING OFFICES IN ALL PRINCIPAL CITIES



We're doing our best TO MEET THE DEMAND FOR EAGLE SUPER "66" Plastic Insulation!

Fuel is only too obviously a crucial weapon in this man's war, and current shortages are making many managers and plant superintendents scrutinize the insulation of their heated equipment.

The almost incredible efficiency of Eagle Super "66" — a mineral wool insulation that is applied like a plastic—has brought about a greatly increased demand for it, due to these basic advantages:

1. *"Springy Ball" Structure.* Chief structural ingredient is Eagle High Temperature Mineral Wool, nodulated into small pellets which are honey-combed by thousands of "dead air" cells. These "springy balls" effectively form a barrier to the flow of heat.

2. *All Purpose.* May be applied to any heated equipment, operated at temperatures up to 1800° F. Exceptional plasticity and adhesiveness make it desirable for all types of surfaces and equipment. Trowels readily in minimum time.

3. *High Coverage.* Wet coverage is as high as 61 square feet, one inch thick, per 100 lbs. Net dry coverage is from 50 to 55 square feet.

4. *Reclaimability.* Used up to temperatures of 1200° F., Eagle Super "66" is 100% reclaimable. It may be removed, remixed with water, reused.

5. *Rust Inhibitive.* Few power and heat installations could be replaced now, require infinite care. Eagle Super "66" is actively rust inhibitive. Properly applied to an iron or steel surface, it effectively checks rust, corrosion.

May we send you catalog sheets containing technical data on efficiency and application? Simply write us!

To Protect Insulation... Eagle Insulseal is recommended. It is a durable, fireproof coating . . . safeguards against air infiltration, moisture, water, fumes and abrasion.

EAGLE-PICHER HIGH TEMPERATURE INSULATIONS

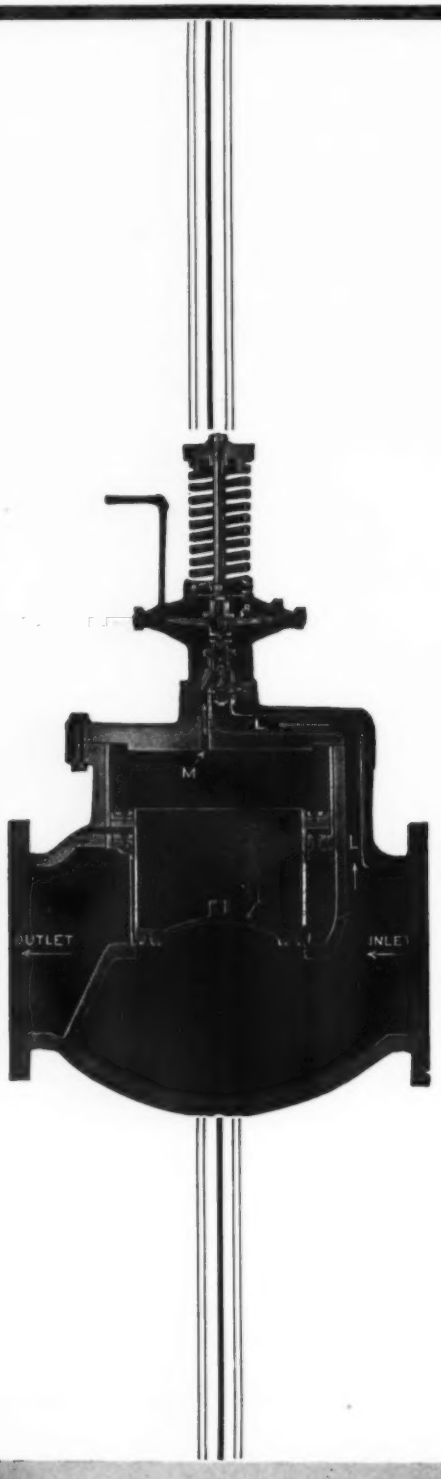
Eagle Super "66" Plastic Insulation
Eagle Supertemp Blocks
Eagle L-T Felts
Eagle Blankets

EAGLE 1843 EP 1943 PICHER

Eagle Finishing Cements
Eagle Loose Wool
Eagle Insulseal
Eagle Insul-stic

THE EAGLE-PICHER LEAD COMPANY, Cincinnati, Ohio

TO KEEP YOUR WATER TANKS or STANDPIPES FROM OVER-FLOWING



INSTALL NOW

the easy-to-install

GOLDEN-ANDERSON ALTITUDE VALVE

★

It maintains a constant, automatic watch over water levels in all types of elevated tanks or standpipes.

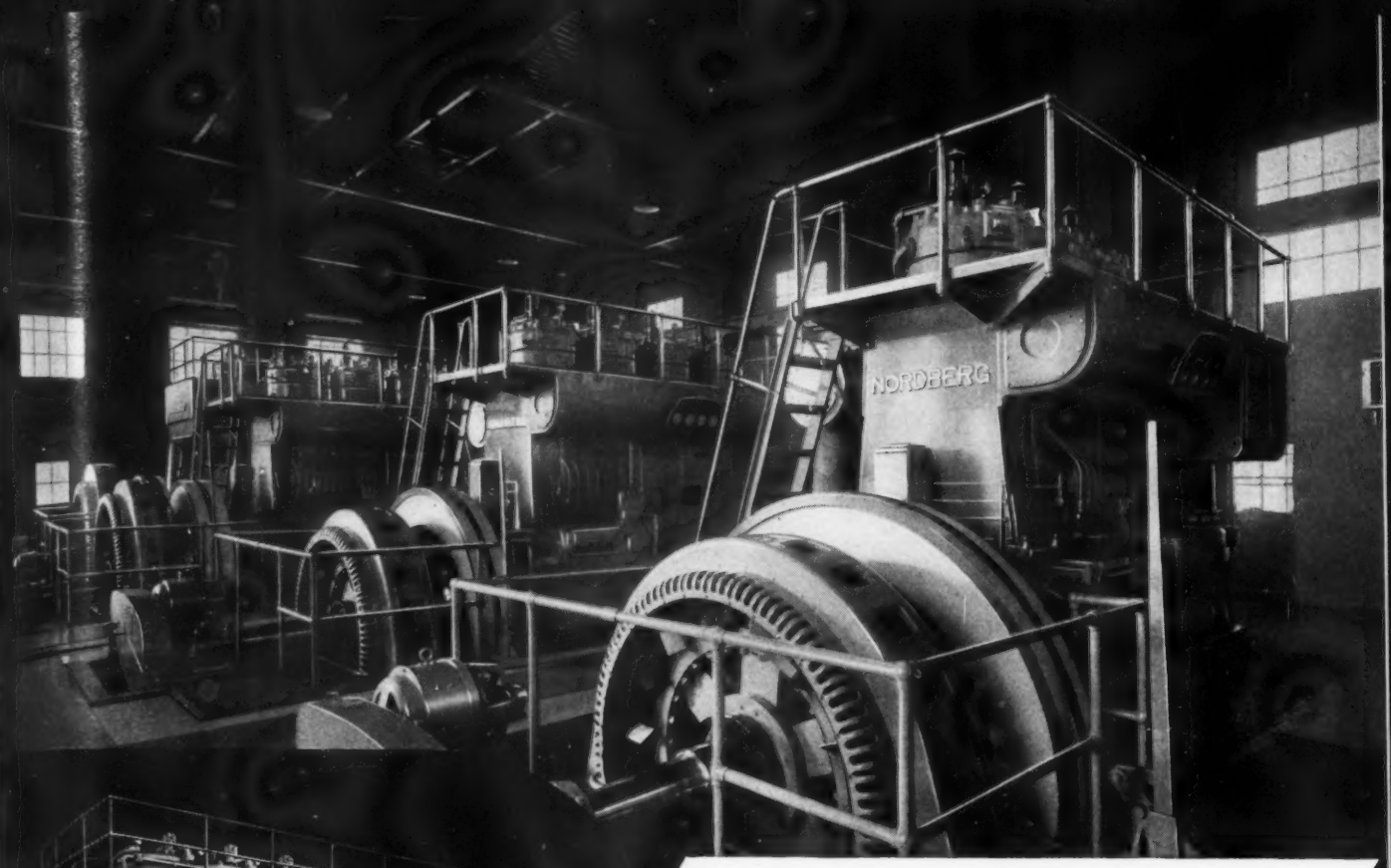
It's easy to install. Keeps water level uniform at all times. Valve always opens to full pipe line area, and when closing, instantly moves to closed position without any hunting.

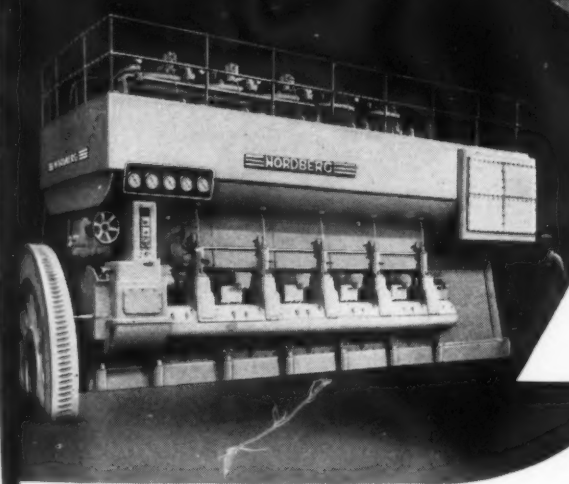
★

Triple Acting and Non-Return Valves for Automatic boiler room protection, Emergency Throttle Stop Valves, Steam and Water Pressure Reducing Valves, Check Valves, etc. Complete line shown in handsome illustrated catalog. Write for a copy.

★

GOLDEN-ANDERSON VALVE SPECIALTY CO.
FULTON BLDG. • • • PITTSBURGH, PA.





4 NORDBERG DIESELS serve this Rural Electrification Project

A large portion of the normal load is carried by a five cylinder, 2000 H.P. Nordberg Diesel as shown above, the largest and latest unit to be installed at the Reeve generating plant.

We are proud to fly the Navy "E" with the added star signifying that excellence in production has been maintained.

An unusually successful record has been established by the Federated Co-Operative Power Association, a rural electrification project serving a half dozen counties centered around its generating station at Reeve, Iowa. The performance of this plant and its rapid growth is evidence of its success. Service was started in 1935 with two Nordberg Diesels of 750 and 1000 H.P. In 1939 a 1500 H.P. unit was added and in 1941 the latest addition of a 2000 H.P. engine was made, the plant now totalling 5250 H.P., being among the larger all-Diesel generating stations in Iowa. That Nordberg Diesels were selected when units of greater capacity were needed is evidence of the satisfactory service given by previous installations.

NORDBERG MFG. CO. • MILWAUKEE

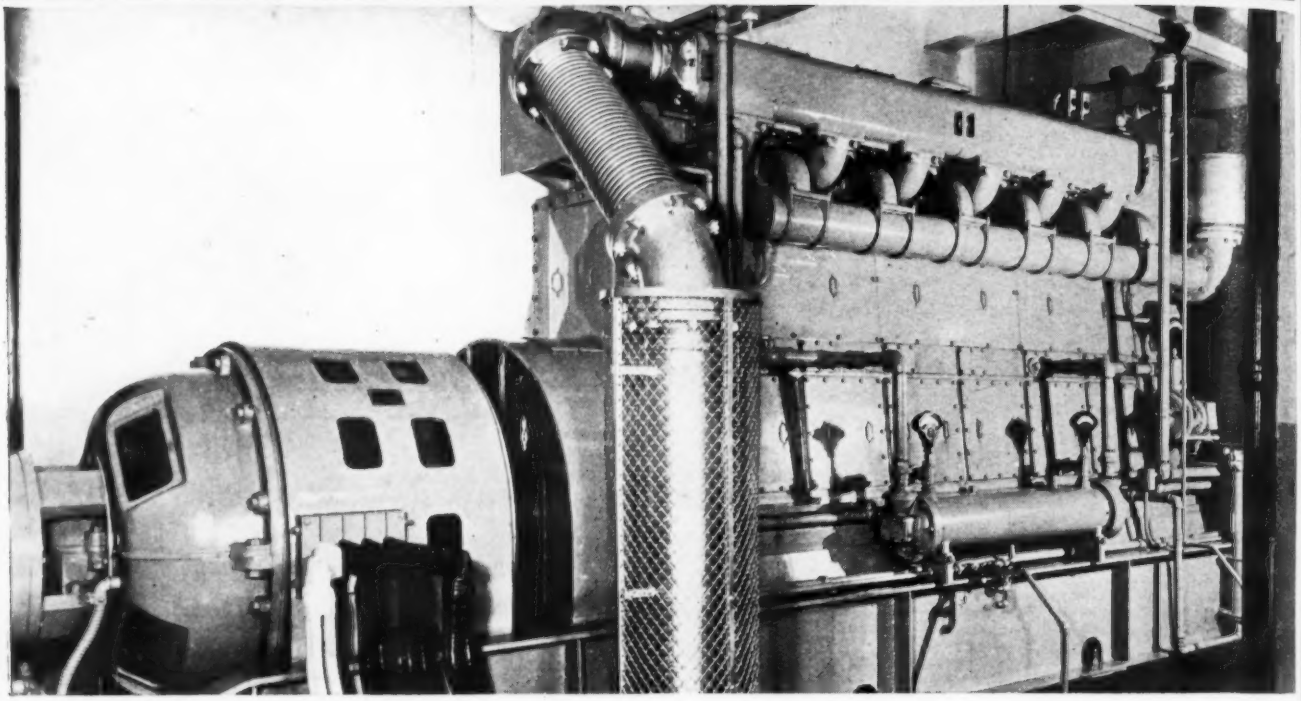
NORDBERG MACHINERY

NORDBERG

DIESEL ENGINES

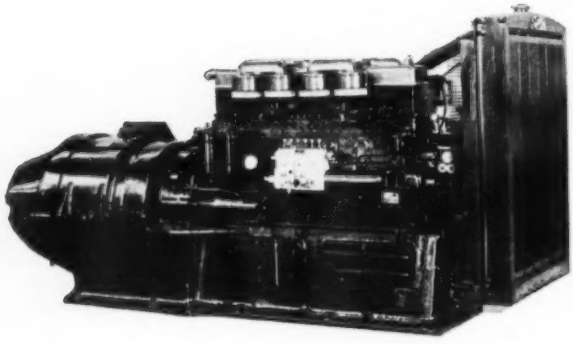
NORDBERG MACHINERY

AN OUNCE OF PREVENTION..



"AN OUNCE OF PREVENTION" becomes vitally important when the "pound of cure" may be unobtainable. Present day conditions demand that the full efficiency of your Diesel be maintained, by proper care and attention, in order that power for Victory may be continuous and uninterrupted. Lessened power, lost time and wasted money are the least of the inevitable results of laxness in the maintenance of an engine.

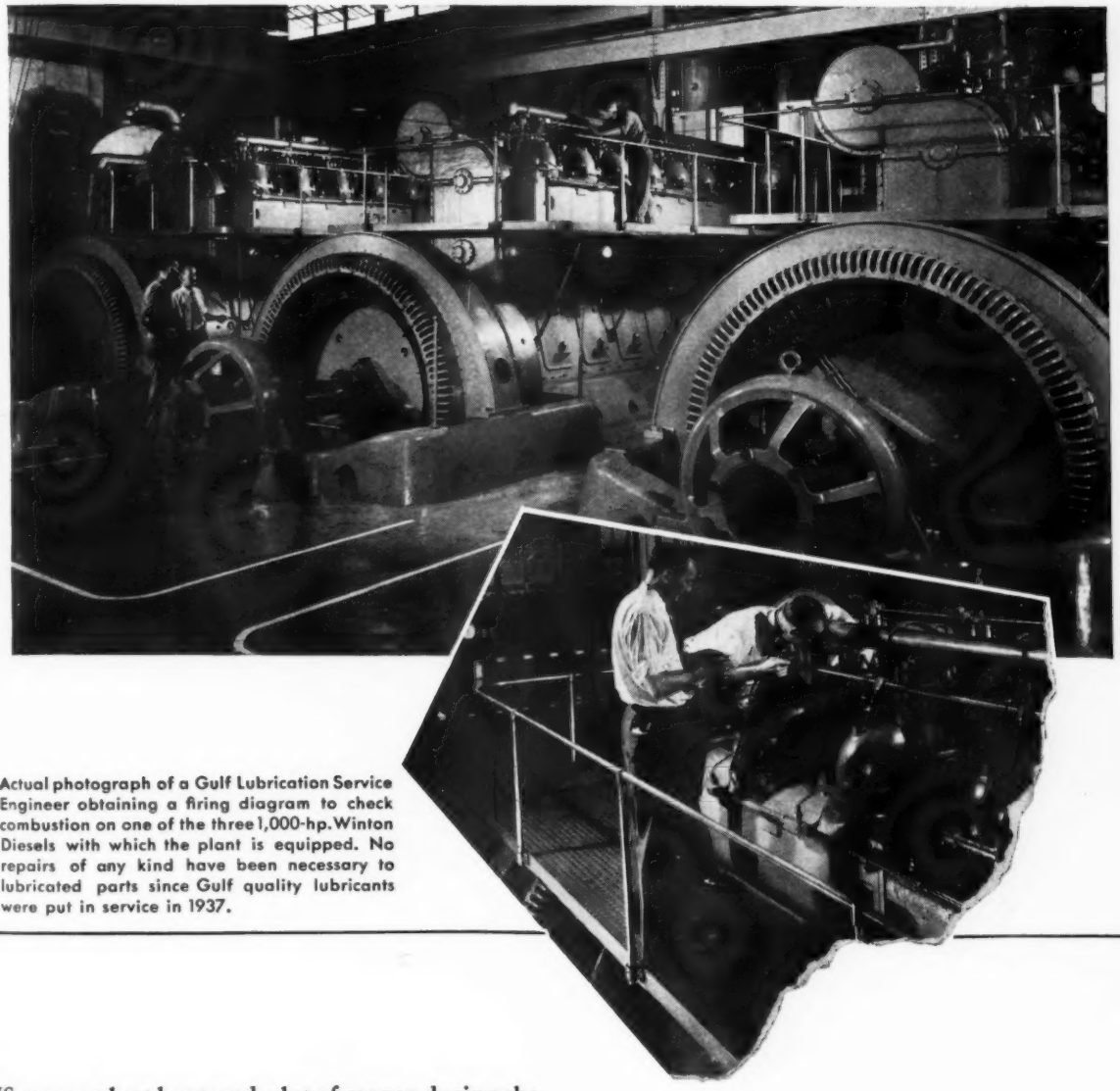
Superior Diesels, sturdy and rugged as they are, nevertheless require regular attention — just as any other precision machinery. To this end we suggest that you call in the factory-trained service engineer, whose extensive experience enables him to make minor corrections or adjustments which, if done *in time*, may well prevent serious trouble or irreparable damage later.



SUPERIOR ENGINE DIVISION . . . THE NATIONAL SUPPLY COMPANY

SALES OFFICES: Springfield, Ohio; Philadelphia, Penna.; New York, N. Y.; Los Angeles, Calif.; Jacksonville, Fla.; Houston, Texas; Chicago, Ill.; Fort Worth, Texas; Tulsa, Okla.; Boston, Mass. FACTORY: Springfield, Ohio

No repairs to lubricated parts in 5½ years operation with **Gulf Diesel lubricating oil!**



Actual photograph of a Gulf Lubrication Service Engineer obtaining a firing diagram to check combustion on one of the three 1,000-hp. Winton Diesels with which the plant is equipped. No repairs of any kind have been necessary to lubricated parts since Gulf quality lubricants were put in service in 1937.

THIS power plant has saved a lot of money during the past 5½ years with Gulf lubricating oil in service in its three Diesels. For no repairs of any kind have been necessary to lubricated parts during this period, and today the engines are essentially in as good condition as when this quality Gulf oil took over the lubricating job.

This is a typical performance record of tough-filmed and stable Gulf Diesel lubricating oils. In plant after plant, these quality oils are helping set higher standards of Diesel operating efficiency and economy.

If you feel that there is room for improvement in the operating or maintenance figures shown in your records, ask a Gulf lubrication service engineer to call. His thorough training and broad experience with many types of Diesels is your assurance of sound recommendations which will help you get more efficient performance and lower maintenance costs.

The services of a Gulf engineer—and the Gulf line of quality Diesel lubricating oils—are quickly available to you through more than 1200 warehouses located in 30 states from Maine to New Mexico. Write or 'phone your nearest Gulf office today.

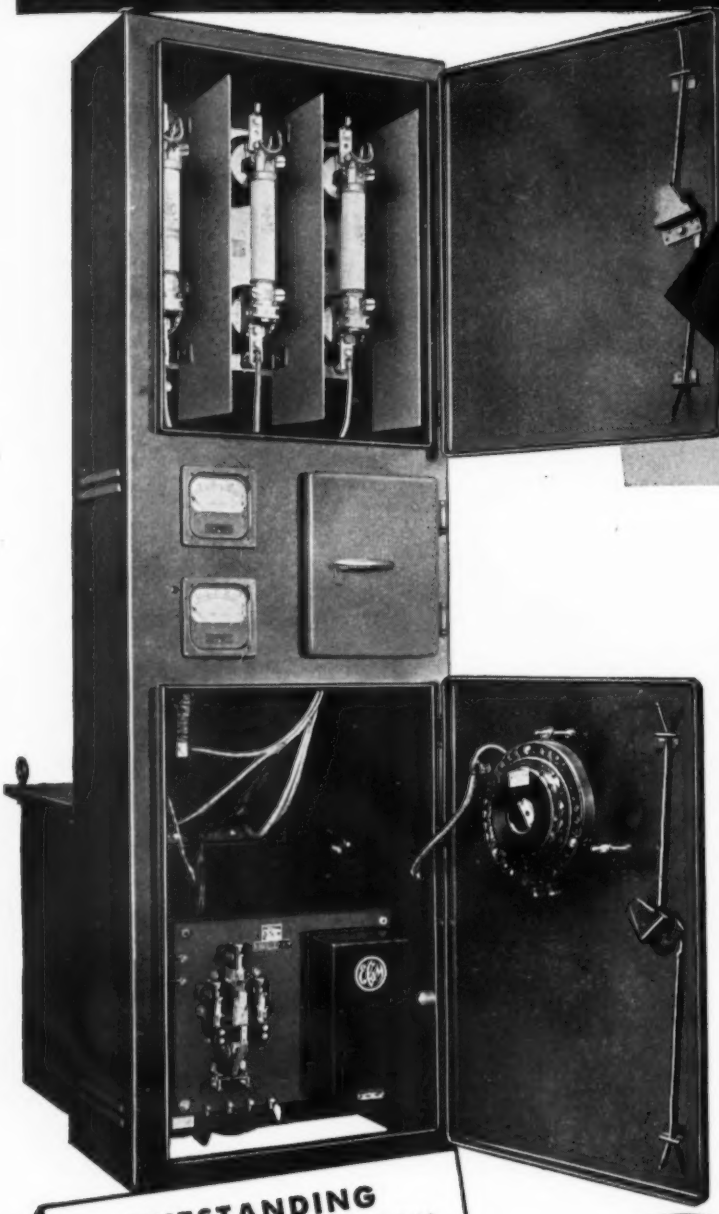
GULF INDUSTRIAL LUBRICATION

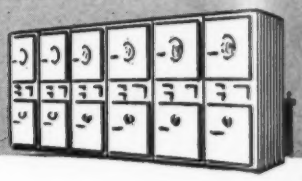
GULF OIL CORPORATION · GULF REFINING COMPANY
GULF BUILDING, PITTSBURGH, PA.

EC&M Steel-Clad MOTOR CONTROL

for 2300 VOLT

SYNCHRONOUS MOTORS FOR SINGLE MOTOR APPLICATIONS OR FOR GROUP MOTOR INSTALLATIONS





WITH all wiring complete, this Control is quickly installed. It has the advantage of single unit use but can be readily assembled into a group of several units due to its unique design and construction.

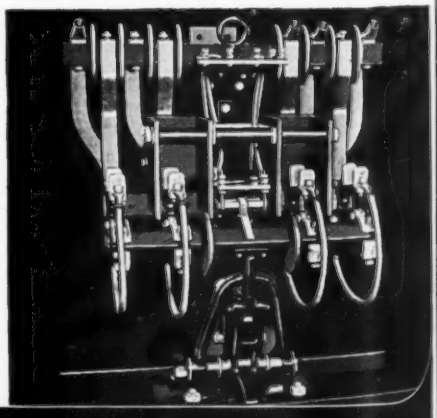
In addition, this unit has disconnect fuses giving short-circuit protection. These are selected to meet normal motor currents and also have sufficient rupturing capacity to meet the requirements of the power-circuit. Motor protection is supplied by EC&M Type ZM Overload Relays which have a reputation for accuracy and reliability.

For illustrations and applications of EC&M Steel-clad Motor Control to meet the requirements of squirrel-cage, synchronous and wound-rotor motors, both low and high voltage, send for Booklet No. 67.

OUTSTANDING FEATURES OF DESIGN

1. Safety interlocks on all starter units.
2. Self-contained bus between units when arranged for group installation.
3. Semi-dust-tite enclosure (NEMA Type 1A).
4. Utmost accessibility through front doors and rear plates.
5. Removable plate on end unit for bus extension when adding units for a group installation.

THE ELECTRIC CONTROLLER & MFG. CO. E&M CLEVELAND, OHIO

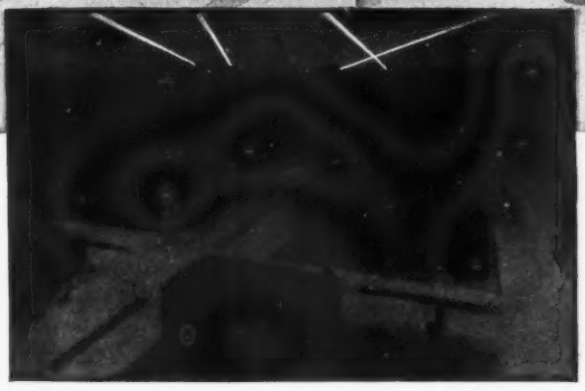


At right: EC&M Magnetic Contactor for 2300 Volt Motor Control Applications.

THE ELECTRIC CONTROLLER & MFG. CO.

CLEVELAND ★ OHIO

Looking ahead with Asbestos



BLACKOUTS ARE ONLY A PASSING PHASE OF ELECTRICAL CONTROL

● If far-visioned men have their way, the post-war world will need—and use—more electrical power than a world at war.

In that tomorrow's world, K&M's Ebonized Asbestos is destined to continue its vital function of electrical control.

For K&M Ebonized Asbestos—asbestos fibre, binding cement and insulating compound molded under pressure—is an ideal material for electrical installations, all the way from huge switchboard panels to tiny switches. Ideal—because it can withstand severe electrical shock, vibration, temperature change; and can absorb high voltages without puncture.

Just now, such needs of war as fighting craft and war industries make it necessary for civilian production to wait awhile for K&M's Ebonized Asbestos. With the coming of peace, however, it will be generally available again—along with those new asbestos products which will emerge from K&M's constant research with Nature's strangest mineral.

* * *

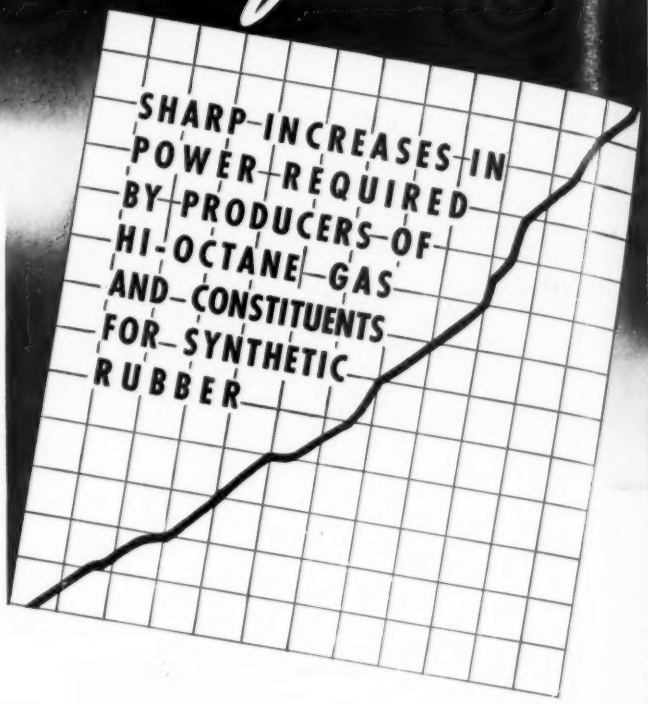
Nature made asbestos;
Keasbey & Mattison, America's asbestos pioneer,
has made it serve mankind . . . since 1873

KEASBEY & MATTISON
COMPANY, AMBLER, PENNSYLVANIA

Makers of

asbestos-cement shingles and wallboards; asbestos and magnesia insulations for pipes, boilers, furnaces; asbestos textiles; asbestos electrical materials; asbestos paper and millboard; asbestos marine insulations; asbestos acoustical material; asbestos packings; asbestos corrugated sheathing and flat lumbers; asbestos-cement pipe for water mains

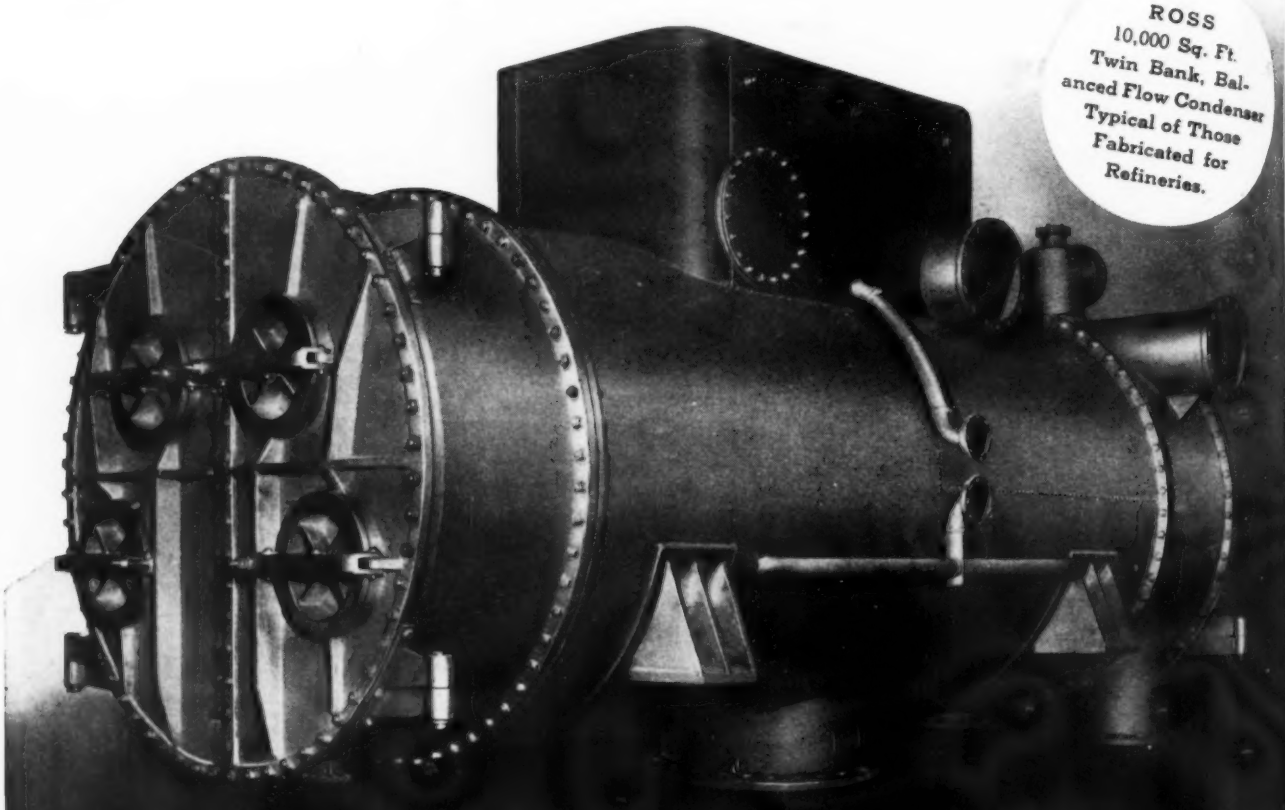
Are You in This Classification?



Wherever power plants are in operation, you'll find a high percentage equipped with Ross Surface Condensers.

This is particularly true of refineries. In 1942, they alone purchased 26 Ross condensers. Most of these units went to companies doing repeat business with Ross over a long period of time. This expresses most convincingly their approval of and confidence in the distinct advantages of Ross design and engineering performance.

If in increasing your hi-octane gas facilities you, too, are faced with the need for additional power, have your nearest Ross representative submit practical recommendations on your surface condenser requirements.



ROSS
10,000 Sq. Ft. Twin Bank, Balanced Flow Condenser Typical of Those Fabricated for Refineries.

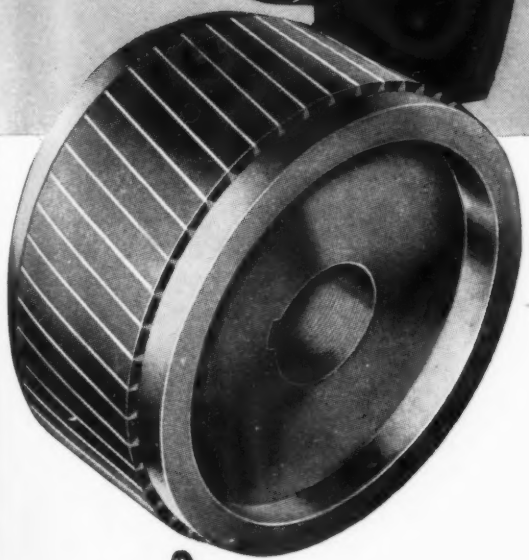
Manufacturers of All Kinds of Heat Exchangers for over a Quarter Century

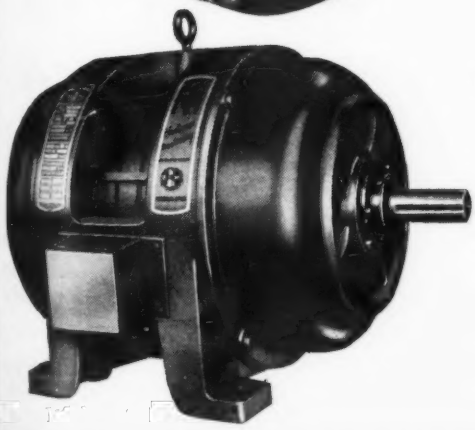
ROSS HEATER & MFG. COMPANY, INC.

Division of American Radiator and "Standard" Sanitary Corporation

MAIN OFFICE AND PLANT . 1409 WEST AVENUE . BUFFALO, N. Y.

When You Can't Buy 'em *BIG*—Buy 'em *GOOD!*





REALLY, it's no hardship when you have to buy smaller motors. *You save money.* But remember, when you can't buy 'em big—buy 'em good.

Now that you cannot depend on oversize to take your motors through tough service—you must depend on quality.

That is why you should investigate Fairbanks-Morse Motors with *Copperspun* Rotors.

The winding of the *Copperspun* Rotor is centrifugally cast of COPPER in one piece. It provides electrical and thermal characteristics that give this motor the stamina to stand up under the most severe service without mechanical failure. You can operate a Fairbanks-Morse Motor with *Copperspun* Rotor at its full rated capacity continuously and indefinitely without fear of damage from overloading.

Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill.

Copperspun

FAIRBANKS-MORSE

DIESEL ENGINES
PUMPS
ELECTRICAL MACHINERY
SCALES
MOTORS

WATER SYSTEMS
FARM EQUIPMENT
STOKERS
AIR CONDITIONERS
RAILROAD EQUIPMENT

Motors

NO WASTED ENERGY HERE

"Buffalo" INDUCED DRAFT FANS

. . . with variable speed drives

Wasted, speed means wasted power. But more important, it means needless wear and tear on rotors and housings. That's why Buffalo Induced Draft Fans with variable speed drives are the practical answer to the draft problem. Fans operate at speeds necessary only to carry boiler ratings. As a result, fan equipment lasts appreciably longer with a minimum of expense and delays for replacements . . . and with more dependable delivery of power for wartime industrial needs.

The Army-Navy "E" Flag . . . awarded to the Buffalo Forge Company for production achievement.

BUFFALO FORGE COMPANY

488 Broadway Buffalo, N. Y.

Branch Engineering Offices in Principal Cities

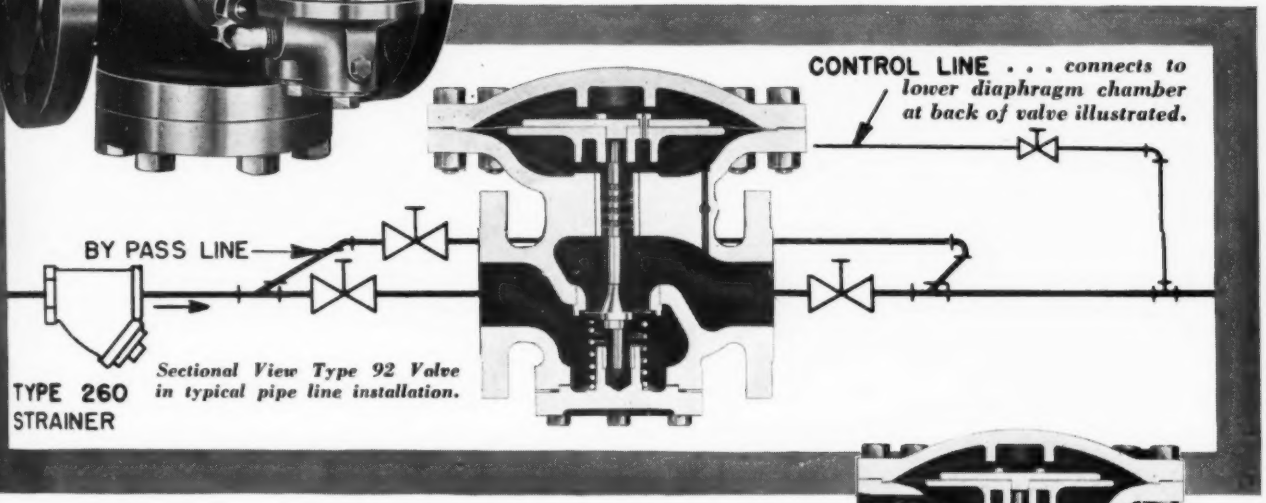
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

"Buffalo" MECHANICAL DRAFT FANS

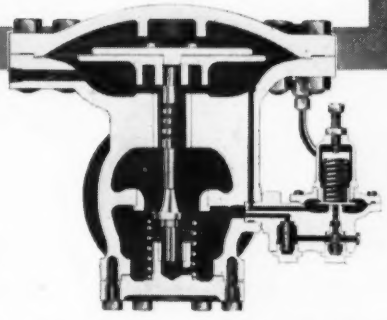
DESIGNED ESPECIALLY FOR STEAM PRESSURE CONTROL!

FISHER TYPE 92

PILOT OPERATED REDUCING VALVE!



Sectional View Type 92 Valve in typical pipe line installation.



Type 92 sectional view showing cross section of pilot assembly.

• The Fisher Type 92 has become the logical choice of engineers for dependable steam pressure control for these reasons . . .

ACCURATE

Pilot control — with its extreme sensitivity to flow changes — maintains the desired reduced pressure with remarkable accuracy. No auxiliary pilot operating medium is needed.

COMPACT

Modern Fisher Engineering has produced in the Type 92 Valve a compact controller with unusually large capacity. Available in 10 sizes from ½" to 2" screwed or 1" to 6" flanged. No special wrenches are required for servicing.

SHUT-OFF

Single port construction provides tight shut-off on dead end service.

FLEXIBLE

Two pilot assemblies for high or low pressure service are available and interchangeable on all Type 92 sizes. Pilot control spring easily adjusted or changed to obtain a variety of reduced pressure ranges.

STURDY

High-tensile bodies and diaphragm castings are of extremely rugged, ribbed construction. Inner parts are of Duromite bronze or stainless steel. Every construction detail designed to assure maximum trouble-free service.

Write for Bulletin C-1

REDUCED PRESSURE RANGES

Pounds per square inch, with low pressure pilot: 2-6, 4-10; with high pressure pilot: 5-30, 60-130, 25-70, 120-200.

MAXIMUM INLET PRESSURES

Screwed Ends..... 250 lbs., 410°F.
Standard Flanged..*125 lbs., 360°F.
Extra Heavy Flanged 250 lbs., 410°F.
* 6" Size — 100 lbs., 340°F.

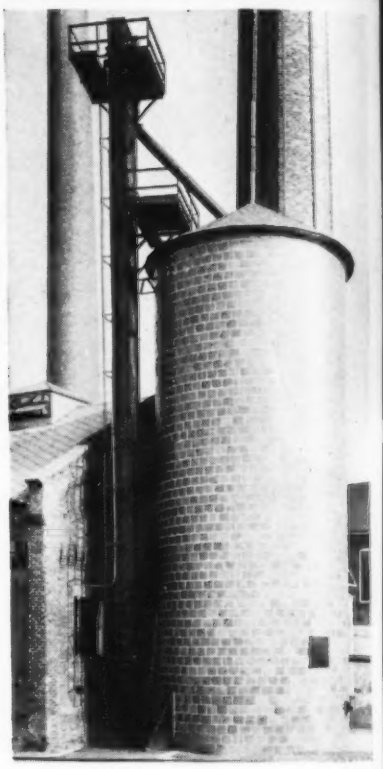
FISHER GOVERNOR COMPANY

424 FISHER BUILDING
MARSHALLTOWN, IOWA

FUEL OIL HAS GONE TO WAR

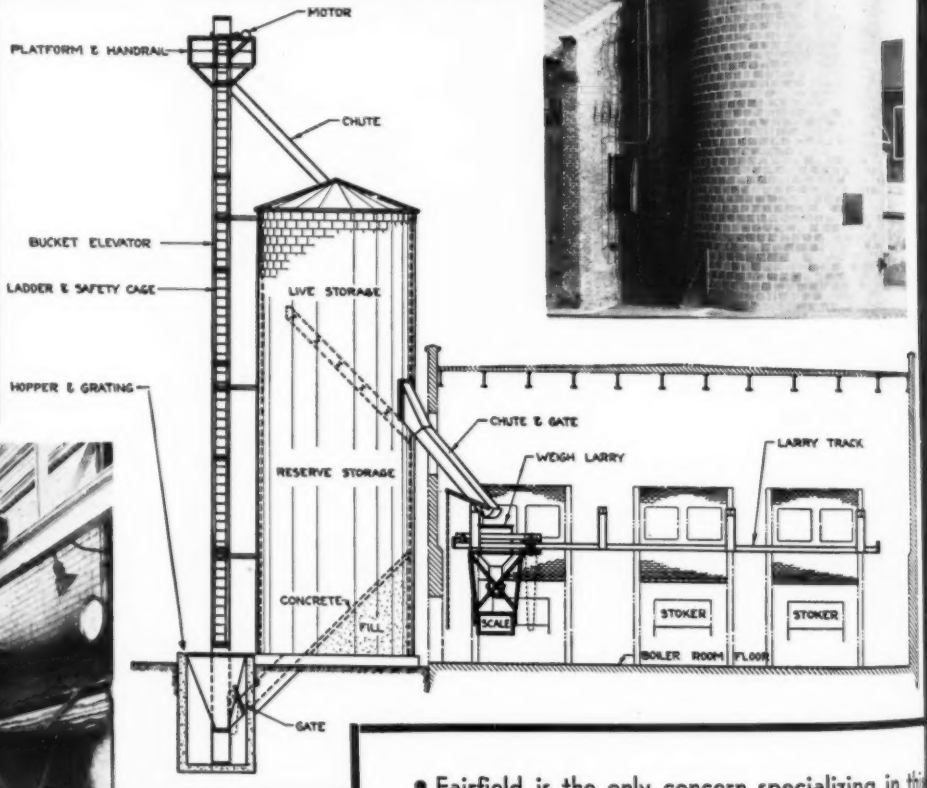
If or When You Convert to COAL
GO ALL THE WAY

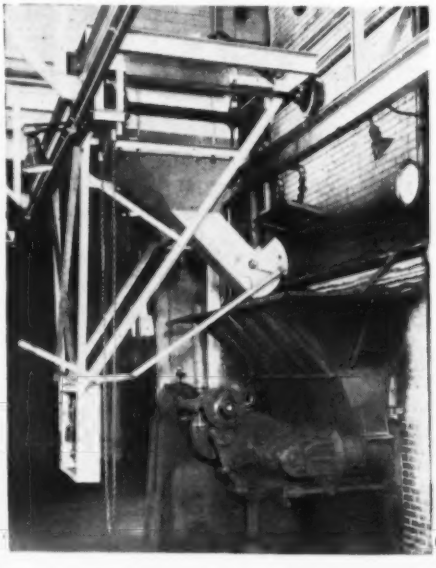
• Your plant may not think you have the space for storage. We can help you there. You may have figured mechanical handling too costly. We can again help you. In fact, for a year we have been most active in the "conversion movement." Your solution, like many others, may be—



The FAIRFIELD SILO SYSTEM

• The Silo, constructed of a non-critical war material (vitrified tile) resists moisture and its wall construction helps prevent freezing. Capacities up to 1,000 tons. Note little ground space required. The silos are ordinarily filled by a bucket elevator and the conveying means to stokers or pulverizers are either a weigh larry or screw conveyor.





• Fairfield is the only concern specializing in this combination of storage and handling. The new catalog is replete with photographs and drawings of dozens of plant installations that might suggest a plan for *your* plant. Why not write for a copy.

THE FAIRFIELD ENGINEERING CO.,— MARION, OHIO

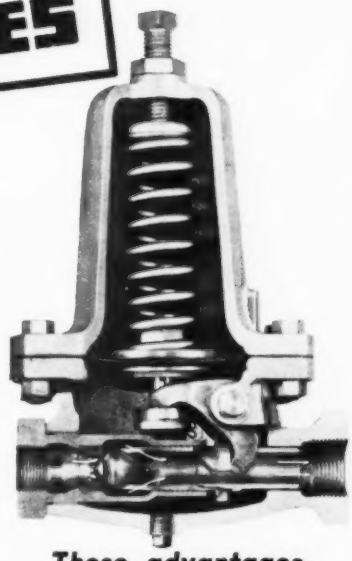
Streamlined
FOR SMOOTH, EVEN FLOW OF STEAM, WATER, AIR, OIL, ETC.

TURBULENCE ELIMINATED
The streamlined form of the inner valve produces the flow pattern shown here. It is the reason users of the "1000" valve get maximum capacity when it is needed most and accurate pressure control even when production hits non-stop proportions and operating conditions really are tough.

Tops IN PERFORMANCE EVEN WHEN PRODUCTION HITS AN ALL-TIME TOP.....

CASH STANDARD *Streamlined* REDUCING VALVES

TYPE 1000 PRESSURE



● Maximum capacity when needed most — accurate pressure control under toughest working conditions — those are points to carefully consider in selecting a valve to fully fit in with all requirements. You get them in the "1000" valve. Here are some actual operating results . . . "To maintain a good uniform quality and to get the utmost out of the machine in the way of production, sensitive pressure control is of prime importance. And, because the machine runs 24 hours a day, dependability is equally important. Your valve never missed a trick." Case No. 340 . . . "We had to have capacity and close regulation, but most of all we wanted a good dependable valve so we would lose no working time with the engine. We got all of that and more. This valve has given excellent service for almost five years without any service attention whatever." — Case No. 325.

Write today for Bulletin 1000—it describes and pictures how, from inlet to outlet the fluid flows through this valve in a straight line—a streamline. Steam, air, and water capacity charts are shown. Eight pages of valuable valve facts.

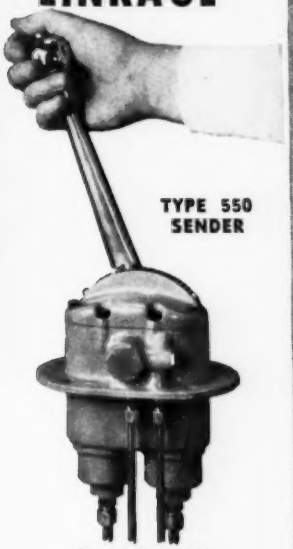
These advantages too add up to your benefit

- Trouble-free service
- Smooth operation
- Tight closure
- Accurate regulation
- Elimination of failures
- Constant delivery pressure
- No spoilage
- Practically zero in maintenance costs
- Speedier production results
- Cost-saving operation

A. W. CASH COMPANY
DECATUR, ILLINOIS

CASH STANDARD CONTROLS.. VALVES

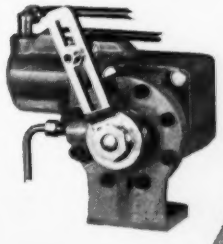
CONTROL APPARATUS REMOTELY *without* MECHANICAL LINKAGE



TYPE 550 SENDER

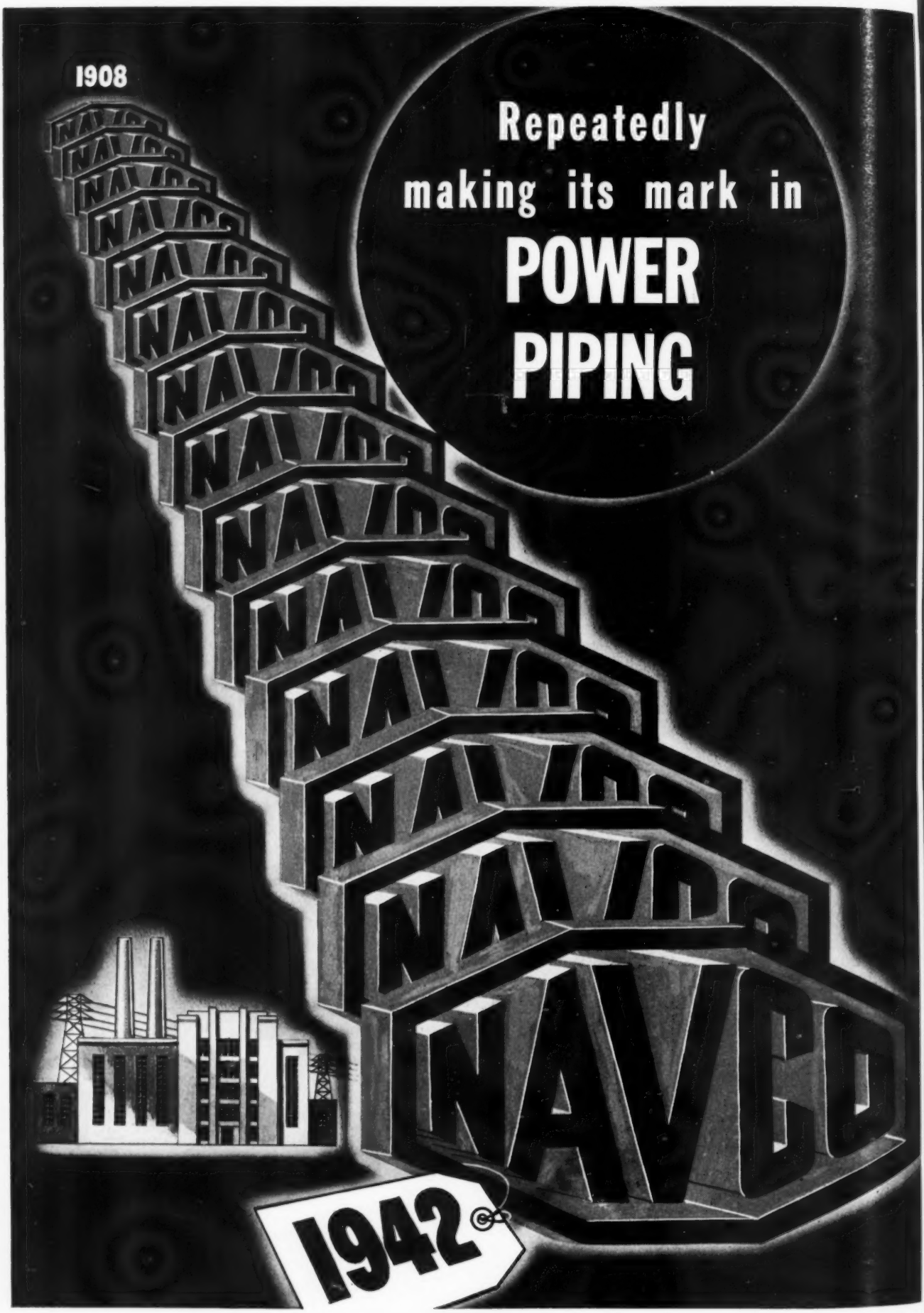
NEW CASH STANDARD *Remote* HYDRAULIC *Control*

This type 550 Remote Hydraulic Control may fit your needs as it is so dependably doing at present for aircraft manufacturers and aeronautical laboratories on engine test cells for controlling throttle position and mixture. IT TRANSMITS OSCILLATING MOTION WITHOUT MECHANICAL LINKAGE. To operate, depress button in control lever with thumb. This releases the automatic brake. Move control lever to any desired position, release button, and control is automatically locked in that position where it will remain indefinitely. The unit . . . a Type 550 Sender (above) and Type 550 Receiver (below) has positive hydraulic power in both directions—no springs, no cups on piston, it transmits the total force applied to the control lever. There is no lost motion in either direction. The lever of the Receiver moves 90 degrees. It can be indexed to any position. For easy mounting the bracket of the Receiver can be indexed to four positions. The Receiver can be installed above or below the Sender.



TYPE 550 RECEIVER

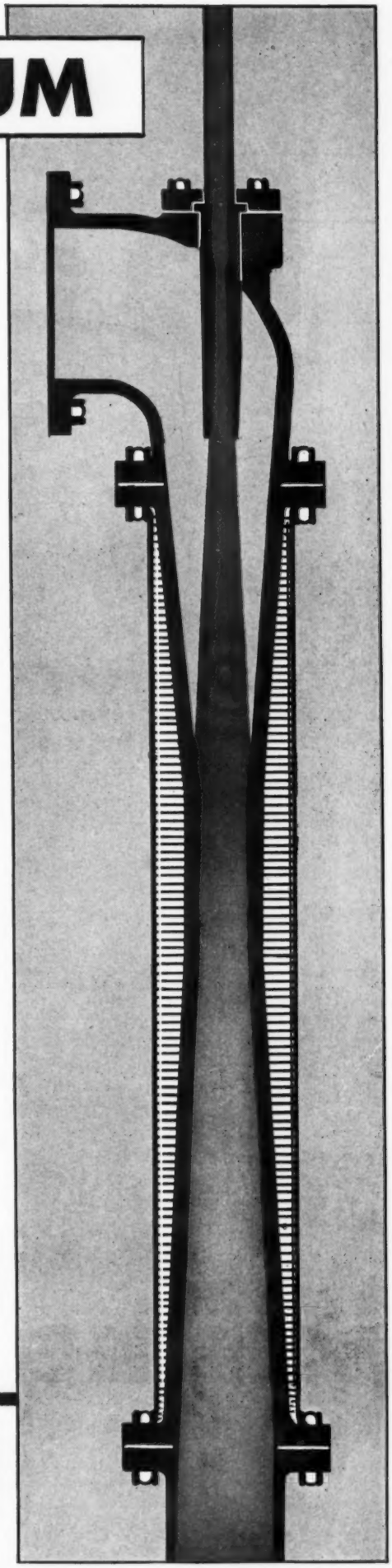
Write for Data



NATIONAL VALVE MANUFACTURING COMPANY • PITTSBURGH, PENNA.

JETS FOR VACUUM

INGERSOLL-RAND STEAM-JET EJECTORS ARE PARTICULARLY SUITABLE FOR PROCESS APPLICATIONS



Ability to handle wet or dry mixtures—I-R Steam-Jet Ejectors handle wet or dry air and gases, and any mixture containing slightly sticky or solid materials, such as chaff, dust, etc. Ejectors can be made of suitable materials to handle high-temperature or corrosive gases. Accidental entrainment of liquid will not damage an ejector.

Any vacuum—Ejectors are available for any vacuums up to, or better than, 29.9″ Hg. (0.1″ Hg. Abs.) Ejectors termed "thermal compressors" are available for boosting steam at pressures above atmosphere.

Any capacity—There is an unlimited range of standard I-R sizes, types and ejector elements to economically meet any capacity requirement.

High efficiency—The design of I-R Ejectors is based on facts accumulated from laboratory and field tests and is proven by thousands of successful installations.

Sustained efficiency—With I-R Steam-Jet Ejectors there are no moving parts to wear out or require lubrication.

Operating stability—Conservative design factors assure satisfactory performance under all operating conditions.

Silent operation—No moving parts, no noise, no vibration—nothing to be adjusted or replaced.

Low installation cost—Little or no foundation is required. Only a small space is needed to install ejectors of large capacity.

Easy to operate—An experienced operator is not required to operate I-R steam-jet ejectors.

Long life — Low maintenance — I-R Ejectors have been designed for long life and low maintenance. Proper materials are recommended by experienced metallurgists. Every I-R ejector installed is backed by I-R service.

Ingersoll-Rand

4-233

11 BROADWAY, NEW YORK, N. Y.

Rapid refueling to get modern planes into the air in double-quick time was the big reason for designing Deming Turbine Gasoline and Fuel Oil Pumps. Their advantages over former refueling systems created an immediate demand. Installations at air bases in the U. S. A. and at other United Nations' air fields are increasing rapidly.

General industry was quick to recognize the advantages of these "easy-to-install, rapid-in-action" turbine pumps. Their numerous applications include their use in fueling stations for trucks, tanks, marine craft, pumping fuel oil from tankers, pumping quenching oil and other liquids, etc., etc.

Capacities range from 50 to 1000 G. P. M. with the 200 G. P. M. the most widely used so far. Complete specifications and related information will be sent promptly upon request. Write:

THE DEMING COMPANY • SALEM, OHIO

DEMING *Industrial* PUMPS

DEEP WELL TURBINES • CONDENSATION RETURN UNITS • SIDE SUCTION CENTRIFUGALS • DOUBLE SUCTION CENTRIFUGALS • SELF PRIMING CENTRIFUGALS • TWO-STAGE CENTRIFUGALS • VERTICAL SUMP PUMPS • CELLAR DRAINERS • SHALLOW AND DEEP WELL PUMPS AND WATER SYSTEMS • JET PUMPS AND WATER SYSTEMS • "TURBO-FLO" PUMPS AND WATER SYSTEMS • TRIPLEX PUMPS • ROTARY PUMPS • PISTON PUMPS

TO
"Convoy" Sound
CLEAR AND UNDISTORTED
Important wartime product of American Metal Hose is Flexible Metal Low-Tension Shielded Conduit which houses electrical wiring on planes and protects radio equipment against static interference.

To convey gas, oil, air and water, as well . . .

Perhaps the most intriguing angle of flexible metal hose and tubing is its seemingly endless range of application. Using practically any work-

American Seamless — corrugated from seamless rigid tubing . . . no welds, laps or joints . . . made in several alloys.

able metal, we can build flexible hose or tubing for anything from a simple spout to a high pressure seamless hydraulic line that can be flexed millions of times without breaking—a line that will give you the flexibility of garden hose, the dependability of metal and the *strength of rigid pipe!*

Whether you need a flexible connector for misaligned or moving parts, for isolating vibration, for conveying air, water, oil,

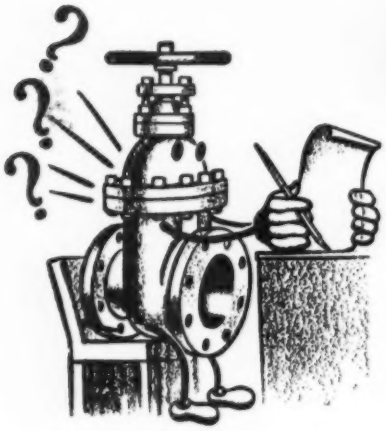
American Interlocked —wound of strip metal, joints packed; the toughest type of extremely flexible metal hose.

steam or fuel, you'll likely find we have a type of flexible metal hose or tubing that will do the job more capably. 43196

American Metal Hose

AMERICAN METAL HOSE BRANCH OF THE AMERICAN BRASS COMPANY • General Offices: Waterbury, Conn.
Subsidiary of Anaconda Copper Mining Company • In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ontario*

AN OCCUPATIONAL QUESTIONNAIRE FOR GATE VALVES



The country's all-out war effort demands that every man, machine and piece of equipment be put to work at the job for which he or it is best suited. Valves are no exception. The many different types of valves in existence today have each been designed for a particular job . . . and they should not be wrongly applied. Here are a few questions and answers in an occupational questionnaire for GATE VALVES.

QUESTION: When should GATE VALVES be used in preference to GLOBE and ANGLE VALVES?

ANSWER: GATE VALVES are preferable for lines on which it is important to minimize resistance to flow. They are necessary where complete drainage of the pipe must be provided. GATE VALVES are suited primarily for locations where valves are to be generally wide open or tight shut because, when used for throttling, the high velocity of flow tends to erode the seating surfaces.

QUESTION: Where are WEDGE GATE VALVES used?

ANSWER: WEDGE GATE VALVES (Fig. 1) are used where gummy liquids are handled, and are preferred for steam service by some engineers and operators.

QUESTION: What are the applications for DOUBLE-DISC GATE VALVES?

ANSWER: DOUBLE-DISC GATE VALVES (Fig. 2) are preferable where liquids containing grit are to be handled, because the flexibility of their operating mechanism enables one disc to seat tightly if grit is caught on the other seat and also because the discs and seats are more readily refaced than those of WEDGE GATE VALVES.

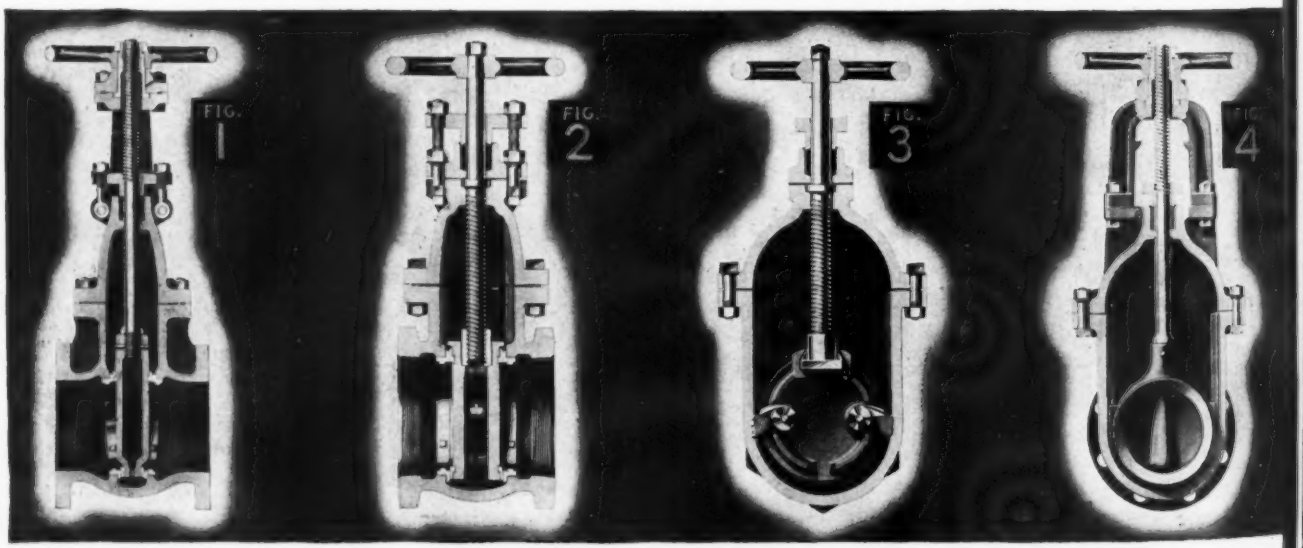
QUESTION: What are the advantages of NON-RISING STEM GATE VALVES?

ANSWER: NON-RISING STEM GATE VALVES (Fig. 3) are usually tighter at the stuffing box than gate valves with rising stems and do not require as much head room.

QUESTION: When should OUTSIDE-SCREW-AND-YOKE GATE VALVES be used?

ANSWER: OUTSIDE-SCREW-AND-YOKE GATE VALVES (Fig. 4) should be used when it is necessary to know at a glance whether the valve is open or shut. The outside screw is also preferable with corrosive fluids, because the stem threads are out of contact with the fluid handled.

If YOU have any other questions you would like to ask about the selection of valves, write to us. As Kennedy makes a complete line of standard valves, you can be sure of receiving unbiased help. For full description of Kennedy valves, pipe fittings and fire hydrants, send for 240-page Kennedy Catalog.



KENNEDY

VALVES • PIPE FITTINGS • FIRE HYDRANTS

THE KENNEDY VALVE MFG. CO. • ELMIRA, N.Y.

Crystolon Brick

ARE HERE TO STAY

There's a permanence about Norton silicon carbide brick which causes engineers to exclaim: "*Crystolon* Brick are here to stay." Recommended particularly for use at the clinker line and bridge wall, these brick will "stand the gaff" at high temperatures and will resist the abrasive action of ash and the motion of the fire bed.

You can use *Crystolon* Brick with confidence when converting from oil to coal in your boiler furnaces. The denseness of these brick prevents molten ash from taking hold by penetration; and they will resist the erosive action of slag. For uninterrupted peak operation *Crystolon* Brick are "just what the doctor ordered."

NORTON COMPANY, Worcester, Mass.

NORTON ELECTRIC FURNACE FUSED REFRACTORIES

This is the face of a gauge that gives new meaning to accuracy and stamina—the Marsh "Mastergauge".

Where have you seen THIS face before?

IT'S a familiar face—the honest face of a good instrument. You have looked at it on boilers, compressors, tanks — innumerable places where proper, safe operation depends on accurate pressure indication. It was chosen in many cases by manufacturers who knew that the success of their products rested in no small part on the truthfulness of its pressure or vacuum indication.

Often that face is the face of a veteran—a gauge that has been at it a long time, operating under tough conditions. But as you trace back over the Marsh Gauges you have known, can you recall a single one of them that has ever failed to do its job right?

To build such a gauge requires more than good design and construction. It takes a great fund of practical knowledge to guide that design—knowledge that can be acquired only in the vast proving ground of industry. It takes the kind of knowledge of every conceivable service condition that Jas. P. Marsh Corporation has been accumulating for more than 75 years.

The Gauge with the "RECALIBRATOR"

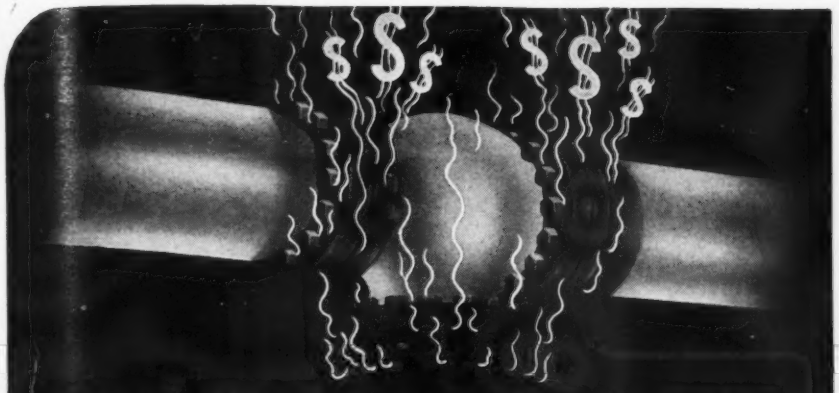
A gauge built to Marsh Standards is not likely to be knocked out of adjustment. But if it is, the Marsh "Recalibrator" will quickly restore its accuracy. Simply turn the "Recalibrator" screw until the pointer is at zero when not under pressure. The gauge will then be right at all points on the dial. Unlike other methods of re-setting, the "Recalibrator" gets at the root of the error — re-establishes the relation of the bourdon tube to the movement — actually *re-calibrates* the gauge.

The accuracy and stamina that you have come to associate with Marsh Gauges is found in all Marsh products — Dial Thermometers, Recorders, Heating Specialties. Naturally, when U. S. Industry went to war, Marsh Instruments were given vital assignments for which their great record so well qualifies them. There is a Marsh Instrument for practically every pressure or temperature measurement requirement.

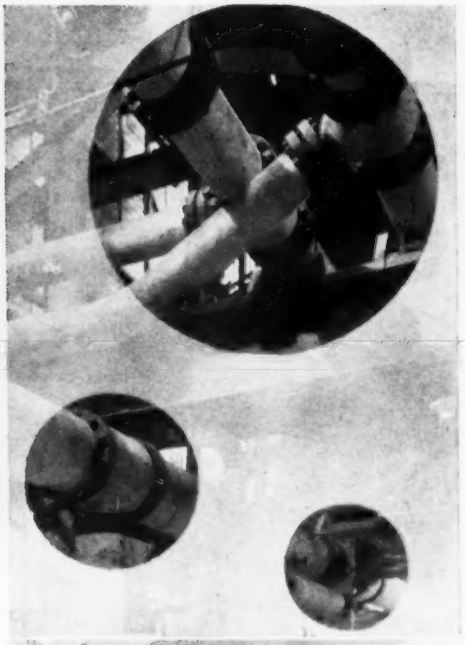
JAS. P. MARSH CORPORATION
2075 Southport Avenue, Chicago, Illinois

MARSH GAUGES

DIAL THERMOMETERS ★ RECORDERS ★ HEATING SPECIALTIES



STOP THESE HIDDEN LEAKS THAT *WASTE YOUR DOLLARS...*



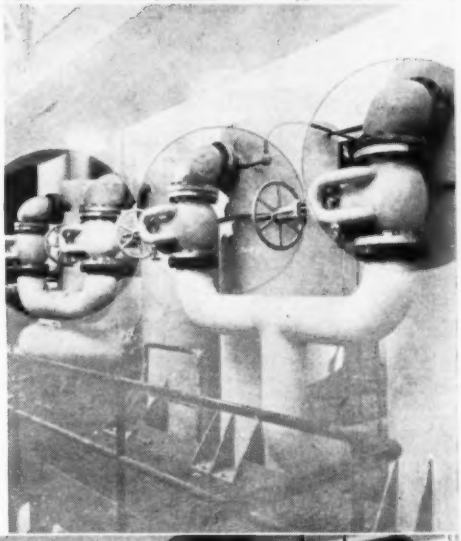
Hundreds of Plants Effect Big Savings with Carey HEAT INSULATIONS

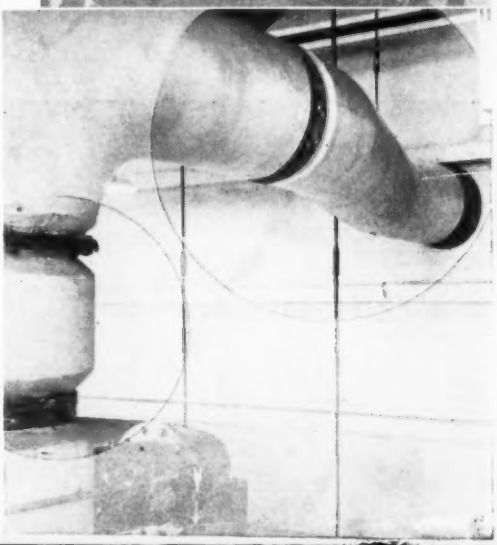
One pair of bare, 10-inch flanges at 350° F., waste one ton of coal per year. One foot of bare, 10" steam pipe, heated to 700° F., can cost you heavy heat loss. Figuring steam cost at 30c per million B. T. U., insulation 3" thick, shows an annual saving of $24.76 per foot of pipe.

Many industrial plants have hidden profit leaks in the form of waste in production, or excessive overhead. While these leaks may be small in themselves, they may add up to a very costly total.

Heat loss, through inadequately insulated pipe, is one of the most common of these hidden profit leaks. Scientific tests show, and hundreds of installations prove, that from 70% to 98% of this loss may be saved by correct insulation.

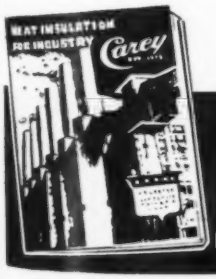
Fortunately for industry, there is a practical way, not only to find these wastes, but also to eliminate them. The Carey organization is equipped to help you uncover the profit leaks in your plant. A phone call or letter to our nearest branch, will bring a representative. Catalog "Heat Insulation for Industry" mailed on request to Dept. 16.





INDUSTRIAL BUILDING PRODUCTS OF
ASPHALT — ASBESTOS — MAGNESIA

ROOFING . . . SIDING . . . FLOORING . . . INSULATIONS . . . ROOFINGS AND CEMENTS
WATERPROOFING MATERIALS ... EXPANSION JOINT ... ASBESTOS PAPER AND MILLBOARD



The PHILIP CAREY *Manufacturing Company*

Dependable Products Since 1873 • Lockland, Cincinnati, Ohio

IN CANADA: THE PHILIP CAREY COMPANY, LTD. Office and Factory: LENNOXVILLE, P. Q.

Usually the

SAVING...

THE MOST IN POWER COST and at the same time getting good drive characteristics—or...

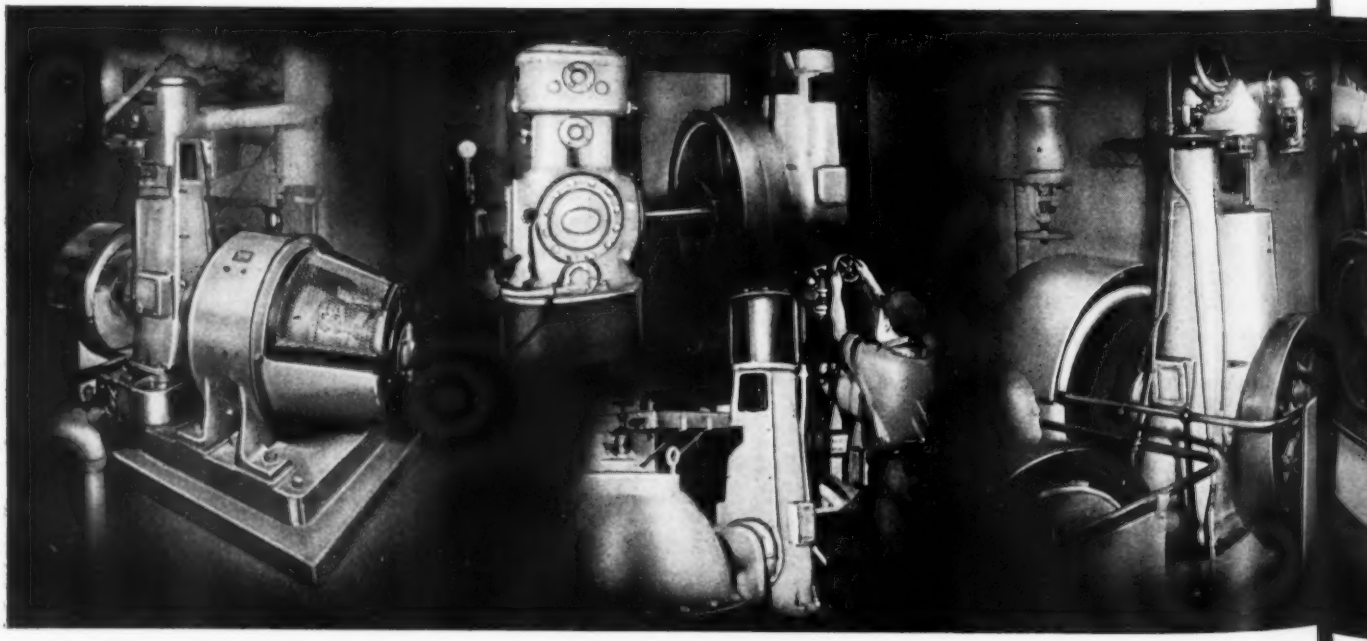
GETTING...

BETTER DRIVE ADVANTAGES at power cost at least as low as that of any other drive—possibly lower.

TROY ENGBERG

TROY ENGINE

ESTABLISHED 1870



User of TROY-ENGBERG STEAM ENGINES *Gets Both*

THE power plant man likes the modern steam engine for its flexibility as stoker and fan drive, likes its responsiveness to changing loads; the oil refinery man likes it for its sure dependability in driving charging pumps; the process plant operator likes it for driving blowers, fans, cookers, dryers, etc. because it helps cut his power costs while providing necessary exhaust steam for processing or heating.

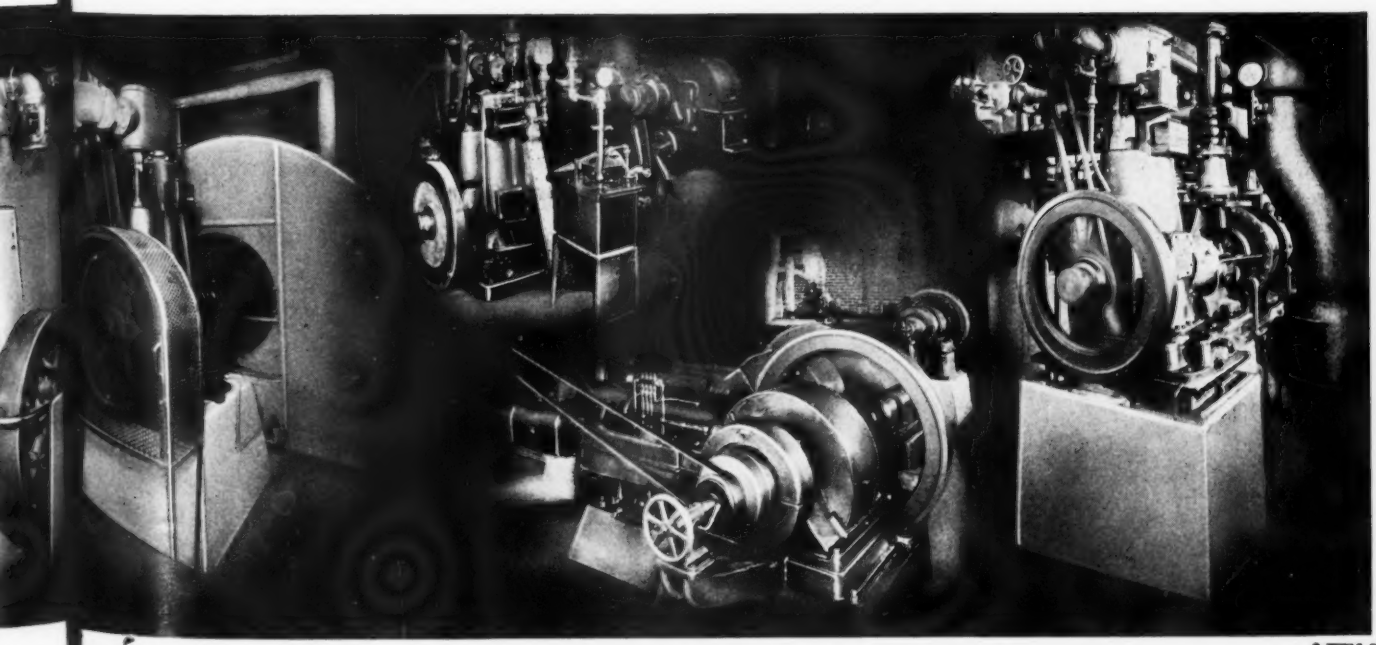
Each type of plant has its own objective when selecting a drive for its major or auxiliary equipment. But none, to our knowledge, has ever knowingly passed up substantial savings in power costs provided the drive characteristics were satisfactory; nor has anyone knowingly passed up superior drive characteristics if satisfactory power costs could be obtained, too.

The point is—do you *know* the Troy-Engberg Steam Engine and what it may be able to do for you in the way of producing power at unbelievably low cost while at the same time providing good drive characteristics?

Seeing is knowing . . . knowing is believing . . . so send for descriptive literature. For example, Bulletin 101 which gives full details of a survey showing the great savings made by over forty companies now using these modern steam engines.

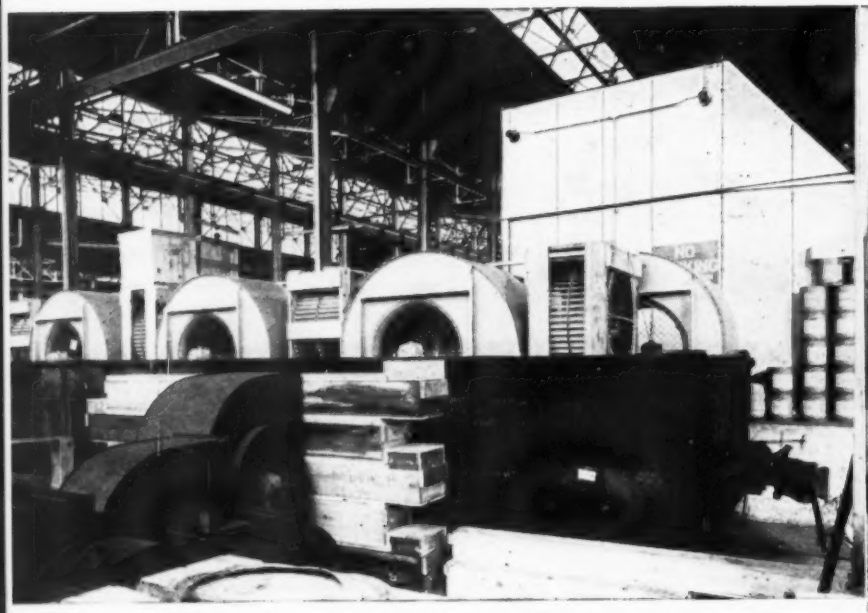
& MACHINE CO.

1484 Railroad Avenue
Troy, Pa.



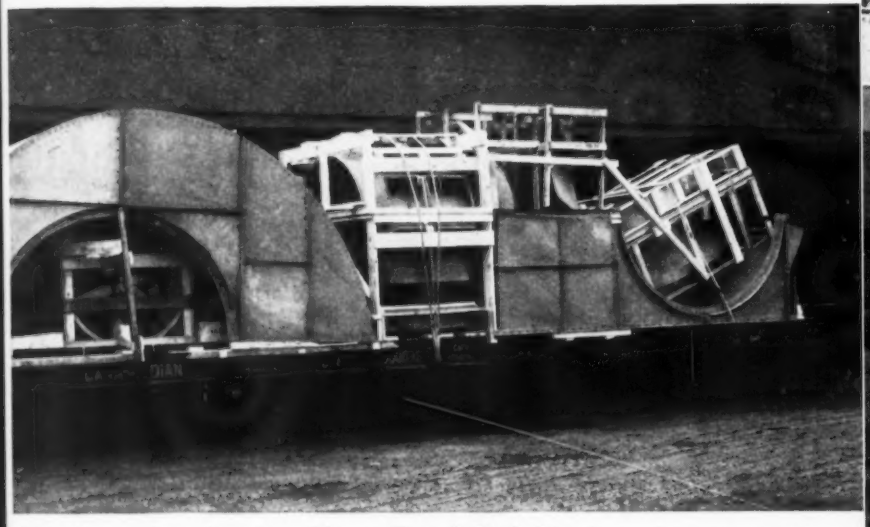
AMERICAN BLOWER "KEEPS

CARLOAD AFTER CARLOAD OF POWER EQUIP

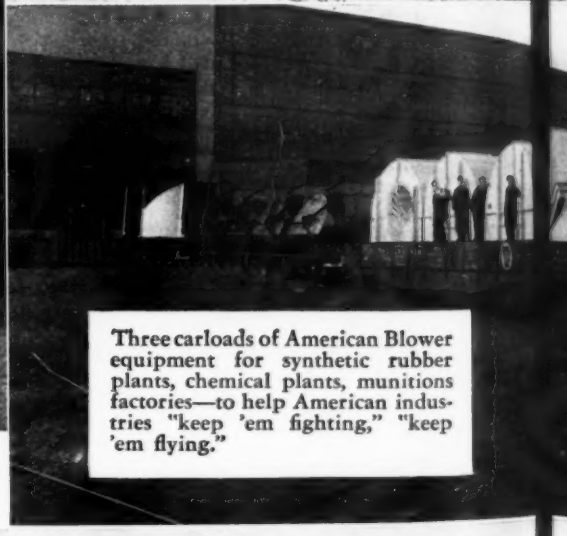


Global war throws a tremendous burden on a shipbuilding program. Photo above shows one of hundreds of cars of Sirocco Forced Draft Fans for U. S. Maritime Commission ships.

An American Blower Induced Draft Fan for another vital power plant. Electricity is the lifeblood of America's war manufacturing machine.



This heavy duty American Blower Forced Draft Fan is on its way to one of America's vital "producers of power"—will soon be helping to generate electricity to build more bombs and bullets, battleships and other war material.



Three carloads of American Blower equipment for synthetic rubber plants, chemical plants, munitions factories—to help American industries "keep 'em fighting," "keep 'em flying."

S 'EM ROLLING"

IP MENT FOR VICTORY!

Heavy duty wheels, bearings and shafts, enroute to a vital smelter.

HATS OFF to American Utilities and American Industry! Your combined efforts have more than met the challenge of the Axis. Now, you are out-producing them in planes, tanks, trucks, guns, bullets, bombs and ships

You've got WHAT IT TAKES TO WIN!

We of American Blower know the miracles you have performed to reach the present peaks of war production. We know what you are going through to step up these peaks again and again.

We're proud that we have been privileged to work with you for this great Cause, privileged to build much of the Mechanical Draft Equipment, Fans, Blowers, Fluid Drives, and other vital parts that have helped to "keep 'em rolling" for Victory.

ARMY E NAVY

MECH. DRAFT · AIR-CONDITIONING
AMERICAN BLOWER
FLUID DRIVES · DUST COLLECTORS

AMERICAN BLOWER

AMERICAN BLOWER CORPORATION, DETROIT, MICH
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONT

Division of AMERICAN Radiator and Standard Sanitary Corporation

General offices, research and engineering buildings, and manufacturing plant of American Blower Corporation at Dearborn, Mi Other plants—Columbus, Ohio, Detroit, Mich., and Windsor, O

You Save in Two Ways by Using

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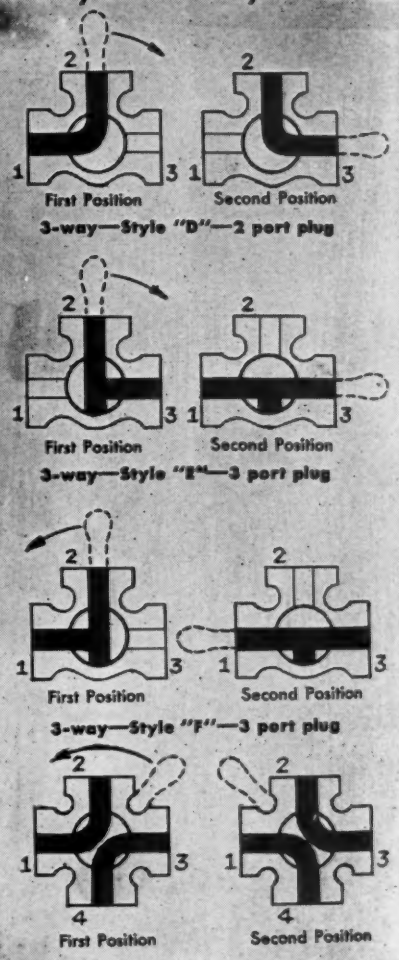
3-WAY AND 4-WAY

VALVES

Fluid flow-lines show how you can use HOMESTEAD 3-way and 4-way VALVES

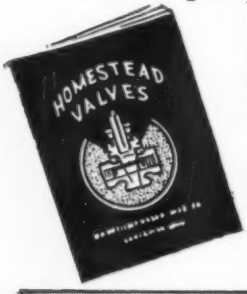


● It's double economy to use 3-way and 4-way Homestead Quarter-Turn Valves as flow changers on steam, water, oil, air, gas, or chemical lines; or to operate single-acting or double-acting hydraulic pistons which do not require a mid-position shut-off.

YOU SAVE in first cost, maintenance and operating time by requiring fewer valves and fittings.

YOU SAVE by getting Homestead's typical, long, trouble-free operation, and extremely low cost-per-year valve service.

These valves are available in sizes from ½-inch to 12-inch, cast in bronze, acid-metal, semi-steel, steel, Monel, Ni-Resist, or special alloys for specific jobs; for temperatures to 1000 degrees F. and corresponding pressures... Get this double economy on your next valve job, by specifying and ordering Homestead 3-way and 4-way Quarter-Turn Valves.



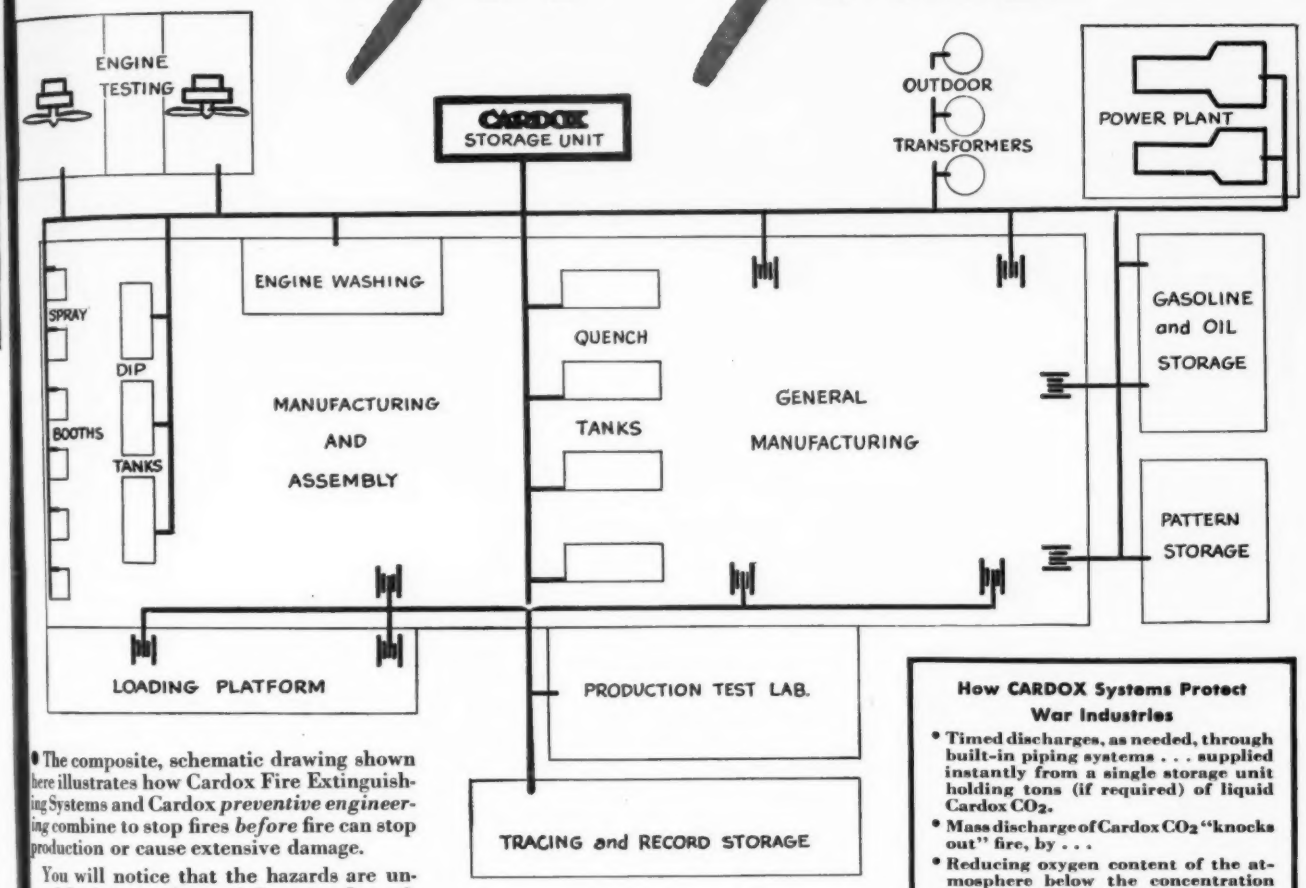
Reference Book No. 38 gives complete information about these, and all other Homestead Valves... Write for your free copy today.

HOMESTEAD VALVE MFG. CO.

MAKERS OF "PEAK PERFORMANCE" VALVES FOR 50 Years 1892 1942

P. O. BOX 210 • • • CORAOPOLIS • • • PENNSYLVANIA

PREVENTIVE ENGINEERING *for fires*



The composite, schematic drawing shown here illustrates how Cardox Fire Extinguishing Systems and Cardox *preventive engineering* combine to stop fires *before* fire can stop production or cause extensive damage.

You will notice that the hazards are unusual, both in number and diversity. In such cases *preventive engineering* provides an entirely practical solution—determining *in advance* and drawing right into the *blueprints* individual hazard requirements for over-all fire protection.

What this means to you is this: With a Cardox System you can protect many hazards in your plant with an application specifically *engineered* to the fire conditions involved, and all part of one complete system.

Further, you obtain the proved, practical advantages of Cardox Systems' enhanced fire extinguishing performance. Cardox Systems extinguish fires by *mass* discharge (in tons, if needed) of Cardox CO_2, supplied from a *single* Storage Unit that stores from 750 pounds to 125 tons of liquid carbon dioxide at controlled low temperature.

War naturally restricts Cardox Corporation to the engineering of Cardox Systems to meet the most vital needs. Whether or not your need qualifies you, make Cardox progressive developments a part of your fire protection thinking. Write, on company letterhead, for Bulletin 923.

CARDOX CORPORATION
BELL BUILDING • CHICAGO, ILLINOIS

District Offices in
New York • Washington • Detroit • Cleveland • Atlanta
Pittsburgh • San Francisco • Los Angeles • Seattle

How CARDOX Systems Protect War Industries

- Timed discharges, as needed, through built-in piping systems . . . supplied instantly from a single storage unit holding tons (if required) of liquid Cardox CO_2.
- Mass discharge of Cardox CO_2 "knocks out" fire, by . . .
- Reducing oxygen content of the atmosphere below the concentration necessary for combustion, and . . .
- Cooling combustibles and fire zone below ignition temperature . . .
- Extinguishing fire quickly and completely *without* damage from extinguishing medium.

CARDOX—CO_2 Systems with Enhanced Fire Extinguishing Performance

A. Uniformity of CO_2 characteristics.
B. Extinguishing medium with uniformly greater cooling effect.
C. Accurate projection of CO_2 through greater distances.
D. Timed discharges, as needed, through built-in piping systems . . . supplied quickly from a single tank holding tons of liquid Cardox CO_2.

MASS DISCHARGE OF CO_2 · ENHANCED COOLING EFFECT · CENTRAL STORAGE UNIT · AMPLE CO_2 RESERVE · ENGINEERED SYSTEMS · MANUAL OR AUTOMATIC CONTROL

CARDOX

NON-DAMAGING FIRE EXTINGUISHING SYSTEMS

COPPER ALLOY BULLETIN

MARINE AND POWER EDITION

REPORTING NEWS AND TECHNICAL DEVELOPMENTS OF COPPER AND COPPER-BASE ALLOYS

Prepared by Bridgeport Brass Company "Bridgeport" *Headquarters for BRASS, BRONZE, and COPPER*

Recognition of Causes Important In Offsetting Tube Failure

Effective Measures May Then Be Applied To Extend Tube Life Under Present Wartime Conditions

The most satisfactory tubing alloy is, naturally, the one which will give the best service as measured in terms of long life and efficient performance under given service conditions. For many years important phases of Bridgeport metallurgical research and product development have been devoted to the study of causes of corrosion and the ways and means to meet and offset the effects of this most common cause of tubing deterioration as encountered in marine and land power stations, as well as in other types of condenser and heat exchanger use.

Alloys containing copper, aluminum, zinc, tin, nickel have proven to give the most satisfactory service when properly selected and installed. However, all these metals have now been "ear-marked" almost entirely for war production, due to the critical shortages in their supply and the tremendous need for their use in all types of fighting equipment.

It therefore becomes necessary for plant superintendents to make the best of the tubing alloys which are available and to watch for signs that warn of tubing attack on present installations. Bridgeport engineers are prepared to advise on whatever steps may be taken at the present time, as well as to assist in future planning. Here are the "failure factors" to watch for and report...

Dezincification

Dezincification has been one of the most common causes of condenser tube failure. This type of corrosion is frequently accelerated by (1) foreign matter settling in the tubes; (2) low water velocities; (3) high temperatures, and (4) the type of circulating water. Ordinary Muntz Metal brass condenser tubes are more susceptible to dezincification than Admiralty. By adding a small percentage of arsenic to Admiralty and Muntz Metal their resistance to dezincification has been greatly increased. As a result, Bridgeport has long made a practice of supplying Bridgeport Admiralty tubing containing arsenic unless otherwise specified by the customer. Arsenical Muntz is also available.

Impingement

In cases of high-water velocity associated with turbine installations, perhaps coupled with turbulent flow, air bubbles and polluted waters, Admiralty Tubes may fail from impingement type corrosion. 70-30 Cupro Nickel, Aluminum Brass and Aluminum Bronze were developed to withstand the impingement action associated with high water velocities.

Pitting

Another type of tube failure is pitting, which occurs generally under deposits of foreign matter and corrosion products. The pitting action is accelerated by active sulphur (hydrogen sulphide and certain organic sulphur compounds) of bacterial origin. The pits produced in Cupro Nickel are, in general, much shallower and wider than those pits produced in Admiralty and Aluminum Brass. This explains the longer life of Cupro Nickel as compared with Admiralty and Aluminum Brass under some service conditions. Laboratory tests have shown that the addition of arsenic still further increases the resistance of these alloys to deposit attack. Bridgeport's Duronze IV (95% Copper, 5% Aluminum) has resisted the combined or individual action of certain corrosive estuary waters and impingement attack better than Admiralty, Aluminum Brass or Cupro Nickel.

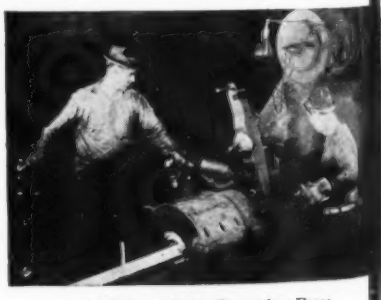
General Thinning

The "general thinning" produced by acids and industrial wastes is very difficult to combat. Frequently the best alloy is selected from a number of alloys by installing sample lots of tubes and testing them under actual service conditions.

* * *

Although low copper alloys and those without nickel and aluminum are being used wherever possible in the interest of conservation, Bridgeport engineers and metallurgists are continuing the company's research unabated. Out of this, and the new experience and knowledge gained in coping with emergency wartime service conditions, many new and important developments are emerging that will be applied at the earliest possible opportunity to provide improved standard alloys and others of timely value to post-war power progress.

In the meantime, Bridgeport is ready to help in meeting your present service problems in any way that wartime conditions will allow.



A Modern Tube Extrusion Press in Action at Bridgeport.

Note: Bridgeport products are supplied in accordance with existing priority regulations.

BRIDGEPORT BRASS

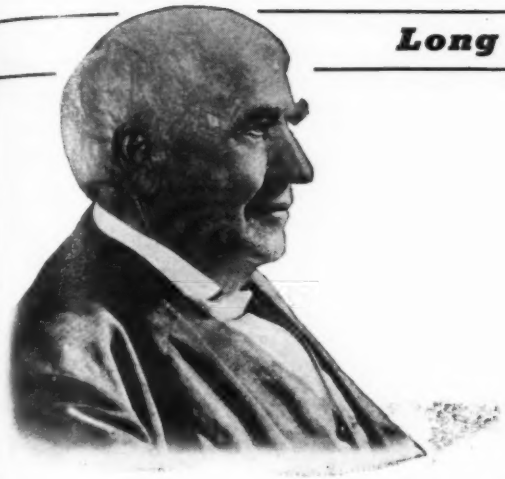
BRIDGEPORT BRASS COMPANY, BRIDGEPORT, CONN.

ARMY E NAVY

BRASS

ESTABLISHED 1865

Long the Leader . . . Ever a Pioneer



. . . . Mister Edison was having trouble

IT WAS back in 1891. Thomas A. Edison had invented a magnetic separator for the concentration of low grade iron ore. He had also created new processes for crushing and briquetting the ore. Now, all he had to do was start production.

But he ran into unexpected difficulties. Not with the separator, or the crusher, or the briquetter. His problem concerned something extraneous . . . but essential. He had conveyor trouble. He had expected to use the only types of conveyors then current: scraper and gravity bucket. Neither of these had ever been called upon to handle abrasive materials (which had always been moved in cars) or to attain the required speed (200 TPH). They failed completely.

Mr. Edison next tried a daring experiment. He used a *belt* conveyor. Up to then, belt conveyors had been restricted to carrying grain. They were thin, had no special cover, and were run flat on wooden idlers. Naturally, they wore out quickly. Another experiment seemed doomed to failure.

The First Belt Made Especially for Conveying Materials

ABOUT that time, a man named Thomas Robins called on Mr. Edison. Being a salesman for a rubber company—and, himself, a pioneering spirit—he was interested in this attempted new use for a rubber product.

After looking over the plant and analyzing the handling problem, Mr. Robins believed that a conveyor belt could be created specifically for the purpose.

In fact, Mr. Robins astonished the great inventor and his colleagues by stating that a piece of rubber, when exposed to the heavy falling stream of crushed ore, would outlast many times its own thickness of the hardest steel. What was more, he could prove it.

Then Mr. Robins ran into difficulties. The company he represented would have nothing to do with such a "crack-brained" idea. But he persisted and finally found a concern willing to produce a belt to specifications. Thus was created the first belt made especially for conveying materials.

From that humble beginning and single idea has grown the present firm of ROBINS . . . long the leader, ever a pioneer in modern materials handling machinery. Submit *your* problems to ROBINS.

ROBINS

CONVEYING BELT COMPANY

PASSAIC • N. J.

For Material Aid in Materials Handling...It's ROBINS

. . One of the things that speeds up the job and makes it better

• Naturally any welder will work both faster and better when he works with fittings that are designed to help him do *his* part right. And you'll find welders pretty well agreed that WeldELLS offer more to the man on the job than any other.

A good example of this—a feature that is found only in WeldELLS—is illustrated above. These precision quarter-markings at each end of every WeldELL make it easy to establish center lines and follow planes. It's typical of the many features, listed opposite, that give the welder a real incentive to do a better job.

The features of WeldELLS that contribute to sound engineering design is still another story—told briefly in the listing, and eloquently by the preference of engineers. But do not forget that the things which mean so much to the welder, mean just as much to the man who designs piping . . . or pays for it.

No other fittings for pip welding combine the feature found in WeldELLS which in addition to quarter-mark ings, include:

● **Seamless** — Greate strength and uniformity.

● **Tangents**—Keep wel away from zone of highe stress—simplify lining up.

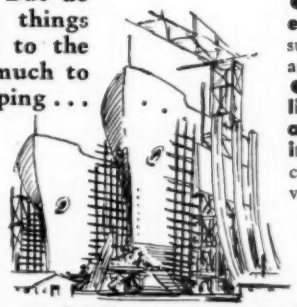
● **Selective reinforce ment** — provides uniform strength.

● **Permanent and com plete identification mark ing**—saves time and elimi nates errors in shop and fiel

● **Wall thickness neve less than specificatio minimum** — assures fu strength and long life.

● **Machine tool bevele ends**—provide best weldi surface and accurate bev and land.

● **The most complet line of Welding Fitting and Forged Steel Flange in the World** — insur complete service and un vided responsibility.



Products vital to modern warfare

The list of Taylor Forge's contributions to the war effort only begins with WeldELLS. Every Taylor Forge product is playing a vital part. One of many examples is Forged Steel Welding Nozzles, essential to hundreds of transports and fighting ships.

TAYLOR FORGE & PIPE WORKS, General Offices & Works: Chicago, P. O. Box 4

NEW YORK OFFICE: 50 CHURCH STREET • PHILADELPHIA OFFICE: BROAD STREET STATION BLD

NOTICE PHOSPHATE USERS

Another Possible SHORTAGE OF SODA PHOSPHATE IS ON THE WAY

• ANOTHER POSSIBLE SHORTAGE OF SODA PHOSPHATES IS ON THE WAY. This is logical, because the first shortage of this for general use was corrected through furnace expansions with resulting greater productions of phosphorus, from which a high percentage of our soda phosphates are made.

The increasing demand for phosphorus by the armed forces through greater war activities points to this condition. This may be serious, as the critical materials required for another expansion in the production of more phosphorus are greatly needed in making ammunition, arms, planes, ships, and as the demands for these increase through extended warfare and through losses in ships and ship cargoes.

SUCH GROWING SHORTAGES IN SODA PHOSPHATES CAN BE MET THROUGH THE USE OF PHOSCALOID

It requires no elemental phosphorus in its manufacture, requires no electric power and requires the minimum amount of labor for processing. It, therefore, has no deterrent effect on the production of phosphorus.

Its value per unit weight in maintaining the required PO4 concentrations within boilers is equal to the best anhydrous soda phosphate. It is the only phosphate treatment with a colloidal base for the effective disposal of all boiler silica problems. It will make mono, di, or trisodium phosphate, or any required combination of these at the plant or point of usage by the simple addition of soda ash or caustic soda.

PROVES MOST ECONOMICAL AS AN AFTER-TREATMENT

In conditioning waters for lime-soda and zeolite softeners, Phoscaloid can be fed direct into these waters through either the suction of the general supply or boiler feed pumps without fear of Phosphate Scale or Corrosion in any equipments through which it travels.

The 7 years' use of PHOSCALOID under many operating conditions, together with 40 years' experience with industries, is the best guarantee as to its performance.

This shortage is not idle thought, neither is PHOSCALOID, because it represents the climax of a "big experience" in water conditioning and is the real answer to this situation in that it does not interfere with the war effort and at the same time provides more water conditioning values per unit weight than any other soda phosphate on the market.

Cyrus Wm. Rice & Company, Inc.

PITTSBURGH *Water Chemists and Engineers* PENNSYLVANIA

More Power *delivered*

gives you More Production!

• And, more power is delivered where Tannate leather belting is used! For, Tannate carries full load; grips tightly, runs smoothly; retains its unusual strength and grip even when exposed to high temperatures, humidity, machine oils and many weak chemicals.

• Consequently, Tannate keeps machines producing at full capacity—three shifts, seven days a week. And Tannate does it with minimum interruption for repairs or for maintenance; with little attention other than an occasional application of Rhoads belt preserver.

• Put all your machines into full production! Get more uniform work, less spoilage, fewer shutdowns, reduced unit costs! *Belt your drives with TANNATE!*

STEP UP PRODUCTION with

RHOADS *Tannate* WATERSHED LEATHER BELTING

J. E. RHOADS & SONS EST. 1702

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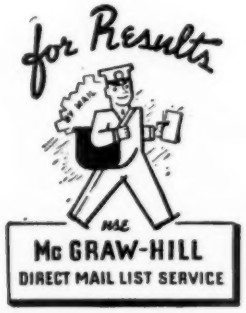

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FOR VICTORY TODAY AND SOUND BUSINESS TOMORROW

Get This Flag Flying Now!

This War Savings Flag which flies today over companies, large and small, all across the land means *business.* It means, first, that 10% of the company's gross pay roll is being invested in War Bonds by the workers voluntarily.

It also means that the employees of all these companies are doing their part for Victory . . . by helping to buy the guns, tanks, and planes that America and her allies *must* have to win.

It means that billions of dollars are being diverted from "bidding" for the constantly shrinking stock of goods available, thus putting a brake on inflation. And it means that billions of dollars will be held in readiness for post-war readjustment.

Think what 10% of the national income, saved in War Bonds now, month after month, can buy when the war ends!

For Victory today . . . and prosperity *tomorrow,* keep the War Bond Pay-roll Savings Plan rolling in *your* firm. Get that flag flying now! Your State War Savings Staff Administrator will gladly explain how you may do so.

If your firm has not already installed the Payroll Savings Plan, *now is the time to do so.* For full details, plus samples of result-getting literature and promotional helps, write or wire: War Savings Staff, Section F, Treasury Department, 709 Twelfth Street NW., Washington, D. C.

EVERYBODY EVERY PAYDAY AT LEAST 10%

Save With

War Savings Bonds

This Space Is a Contribution to America's All-Out War Program by

POWER

"TOLEDO"
TRADE-MARK REGISTERED U.S. PAT. OFFICE

TOOLS HAVE GONE TO WAR

We are sorry if we are unable to serve our old customers, the engineers, plumbers, and steamfitters of America, as we have in the past, but we are indeed proud to have "TOLEDO" tools chosen to take such a prominent part in America's war effort.

Thousands of "TOLEDO" tools and dozens of "TOLEDO" power pipe machines are leaving our plant each month for the various armed forces and shipyards and are assisting in the construction of America's new war plants.

"TOLEDO" tools have gone and are going to our many outposts in this World War, Midway Island, Australia, Hawaiian Islands, Alaska, Newfoundland, Africa, and the British Isles. Here in America hundreds are being shipped to new air bases, army camps, naval bases, shipyards, ordnance plants, and our new synthetic rubber plants.

Yes, "TOLEDO" tools have gone to war and we are proud of this fact. We know "TOLEDO'S" hundreds of thousands of old-time users will understand and excuse us when we say prompt shipments cannot be made of orders with low priority ratings, for America's war orders of course have the right of way.

When Victory comes and peace time projects are again resumed, "TOLEDO" will once more be ready to serve you as in the past.

Safeguard your tools, give them the best of care, regrind dies when dull and order repairs only when necessary. We will try and take care of your needs.

THE TOLEDO PIPE THREADING MACHINE CO.
TOLEDO, OHIO *NEW YORK OFFICE, 502 No. 2 RECTOR STREET BLDG.*

"TOLEDO"
TRADE-MARK REGISTERED U.S. PAT. OFFICE

This Float Valve is Guaranteed to be Positively

DROP TIGHT

Angle, Fig. 214.
Globe, Fig. 214a.

It is superior in every way to ordinary float valves. The float shown here merely "Pushes a Button" and then SUPPLY PRESSURE does the actual heavy work of valve manipulation. It is the

ATLAS
Auxiliary Operated
Float Valve

Another distinctive feature: the auxiliary valve does not have to move more than ¼ in. to open fully or close the main valve. Result: Extremely sensitive and accurate operation. Can be installed within the tank or in the supply line outside the tank and operated by a float in the tank. Strong and durable. Sizes ½" to 10". Globe or angle. Screwed or flanged. Complete data on request.

We make regulating valves for every service. See list of leading products in the coupon below.

ATLAS VALVE COMPANY
REGULATING VALVES FOR EVERY SERVICE
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Please send information on the following Atlas Products without obligating me in any way:

☐ Float Valves ☐ Exhaust Control Systems ☐ Thermostats
☐ Campbell Boiler Feed Water Regulators ☐ Damper Regulators ☐ Balanced Valves
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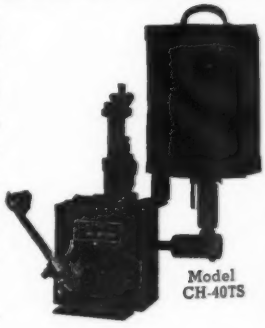
MANZEL LUBRICATORS on Your Heavy Machinery Will Relieve Your Lubrication Problem

Manzel Force Feed Lubricators are fully automatic and positive in operation. They deliver exactly the required amount of oil on each pump stroke. Engines, compressors, pumps and heavy machine tools maintain peak production and operate with minimum attention when Manzel lubricated.


Model CH-40TS

Manzel Lubricators conserve oil, too. They pump exactly the amount required for proper lubrication and every drop is delivered at lubrication points at the right time. Manzels start, stop, speed up and slow down with the machine. Feed is easily adjusted and very accurate.

Manzel lubricators are available with plain or liquid sight feed and with from 1 to 30 feeds.

Write for Catalog 25-C

MANZEL BROTHERS COMPANY
326 Babcock St., Buffalo, N. Y.

There is a NEW Way to WELD Pipe

With WEDGE Split CHILL RINGS

1→ SAVE LABOR

2→ SAVE MATERIAL

3→ SAVE TIME

Split Feature Patented

The WEDGE Chill Ring with the patented SPLIT feature is a very important development because it enables you to weld FASTER and BETTER—at the same time producing a STRONGER joint. They operate in such a way that even less skilled help can do a good job of welding. WEDGE Chill Rings deserve serious consideration on your next job.

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WEDGE PROTECTORS, INC.

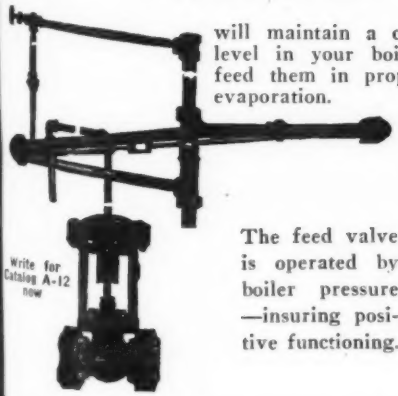
524 Richmond Ave. Cleveland, Ohio

WEDGE CHILL RINGS SAVE MONEY

For Safe Boiler Operation

The Genuine Squires

Boiler Feed Water Controller



will maintain a constant water level in your boilers and will feed them in proportion to the evaporation.

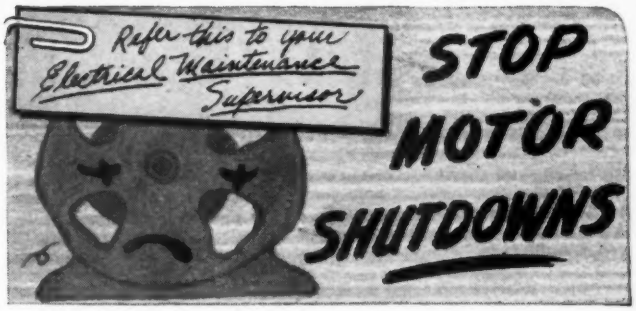
The feed valve is operated by boiler pressure —insuring positive functioning.

Squires

Trade Mark Reg. U. S. Patent Office

THE C. E. SQUIRES COMPANY

East 40th St. and Kelley Ave., Cleveland, Ohio



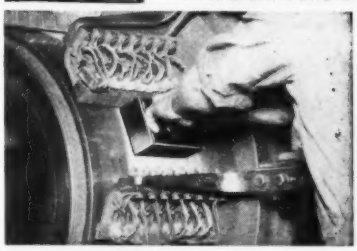
It's not necessary to disassemble motors for smoothing up or trueing up worn Commutators or Slip Rings —or for cutting down high mica. You can do the necessary work—right on the motor—and quick—with the IDEAL Resurfacers, Grinders and Undercutters shown below.

IDEAL Commutator Cleaning Stone

Quickly Removes Excess Film

A few seconds' application periodically, cleans away excessive deposits of dirt or brush material caused by heavy and continuous power loads. Doesn't cut commutator; doesn't clog. Helps to seat brushes and increase brush life. 5 sizes.

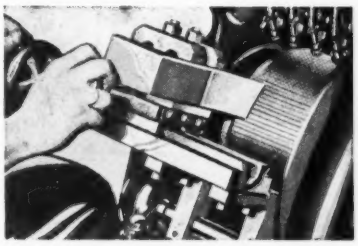
IDEAL Resurfacers



Keep Motors On the Job, WITHOUT DISMANTLING

Quick, easy way to periodically smooth up Commutator and Slip Rings. Eliminates ridges, grooves, pits, high mica. Refinish to a smooth, highly polished surface. No dismantling; no production delays. Over 175 styles and sizes.

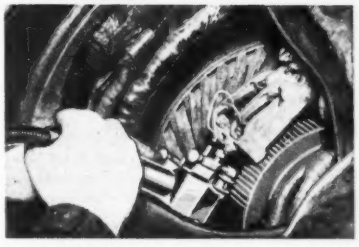
IDEAL Precision Grinders



True Up Commutators and Slip Rings In Own Bearings

If Commutators and Slip Rings are badly grooved, scored, or out of round, this is the easy way to restore to original efficiency, WITHOUT DISMANTLING. Mount directly on motor frame; grinding is done at normal operating speeds. 3 models.

IDEAL Mica Undercutters



For Undercutting High Mica

Three Models: (1) "Direct Drive", for small commutators. (2) "Universal", for small and medium size commutators. (3) "Shop Model", for large commutators.

Write for Literature on Complete Motor Maintenance Line

IDEAL COMMUTATOR DRESSER CO.

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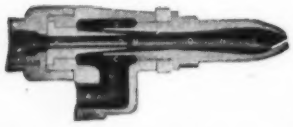

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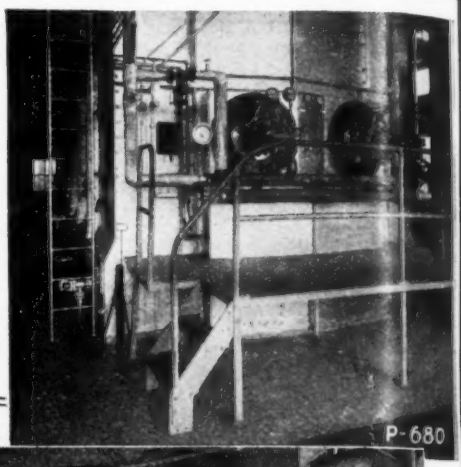

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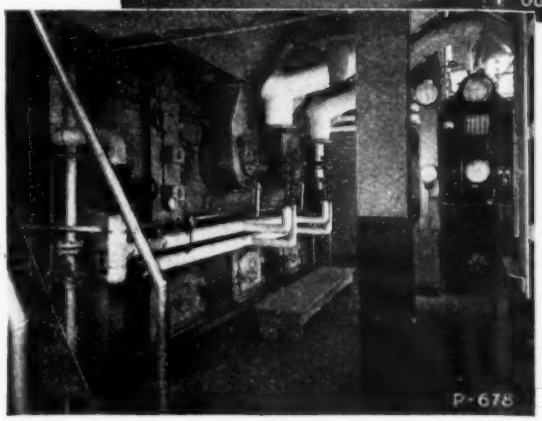

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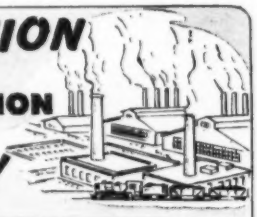

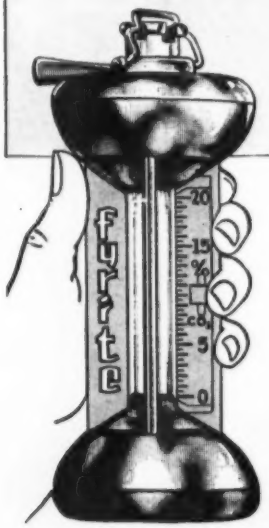

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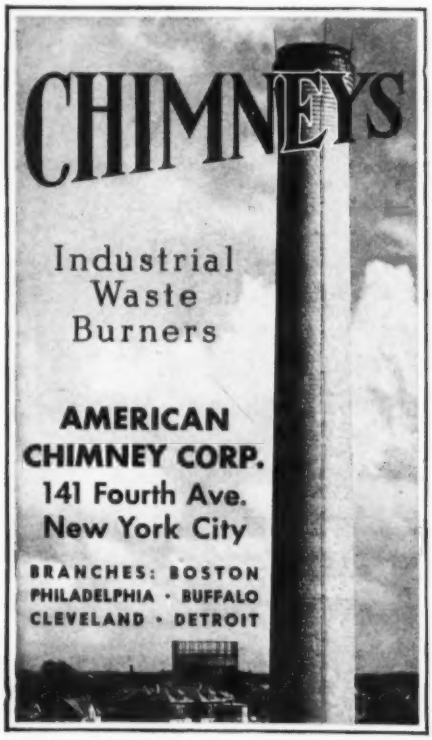

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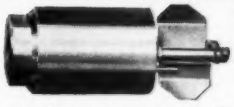

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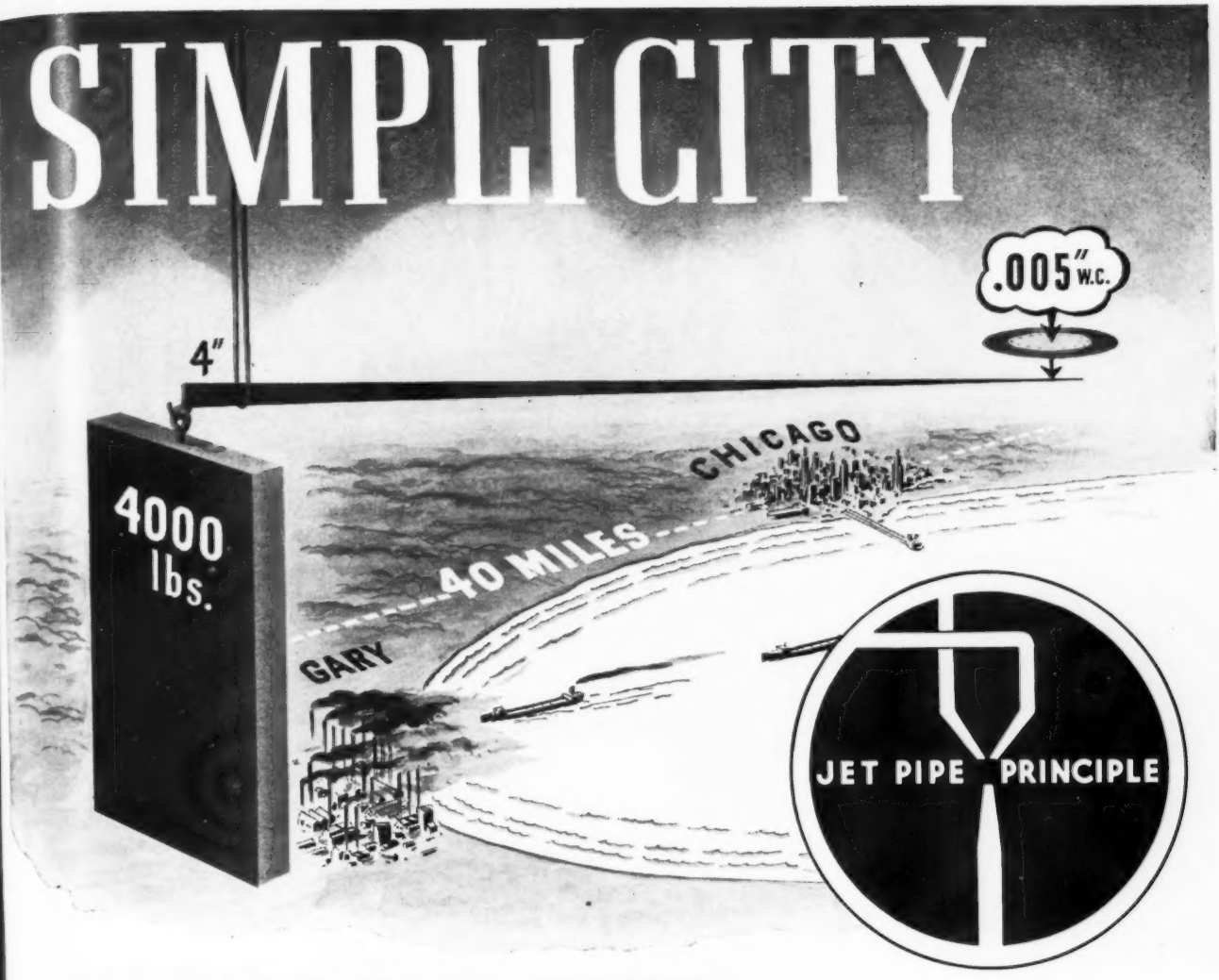

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Tiny cubes and spires will appear upon the horizon. Slowly, they will rise and rise until they tower above the ship in the majestic symmetry of an American skyline.

► As our sons and brothers pour ashore, the post-war world will begin—whether we are ready for it or not.

It behooves us to be ready.

In a war, it's a good rule to produce weapons in fear of defeat, but also to produce peace plans in fear of victory . . . And when we plan for peace, let's see that our "Castles in the air have their feet on the ground."

We know our men will come home to a land of tall buildings, fertile fields and swift transportation. Those things were in being when they went away.

But our post-war world will depend upon how we *use* the tools at hand, not upon the mere fact that we have them.

We *could* embark upon a vast new expansion of industry, based upon new production techniques and the use of light metals, plastics, and electronics.

We *could* foster world-wide trade that would raise the living standard of all peoples to our own level.

If we *could*, why not do it?

► We'll muff the job unless we keep our air castles tied to the ground. We have the ability and the will, but we may not understand how jobs are made and civilization is spread.

If we hold on to the fact that art, science, political experiments, luxuries AND necessities *all* must have their foundations in healthy industry, we will be more careful about doing the things that will keep business healthy.

When we realize that business progress is the foundation of all improvement, our tax laws will stop confusing personal profit (salaries and dividends) with reinvested profit.

► Profit held for reinvestment is the SEED MONEY of business. It is the money a business saves from current operations to insure future growth.

Business will need billions of "Seed Money" dollars when the war is over. But, under the present tax law, they cannot save as they should for that rainy day.

You hear lots of talk about the jobs that will result from the transparent automobiles and the sky-sedans

Air have had their Feet on the Ground

that industry will build after the war, but not enough talk about the need for SEED MONEY to turn those hopes into realities.

The practical fact is that business cannot adjust itself to post-war production without "seed money."

▶ "Seed money" will pay for the research that must come before new and better post-war products can be built. It will pay for retooling when new models are produced. It will pay for the study of methods to get the lower costs that will make it possible for more people to buy. It will pay for setting up new distributors and dealers, and for hundreds of other activities that are involved in the *growth* of business.

The tax law should be adjusted to allow business to accumulate funds for these necessary tasks of post-war development.

Ask your Congressman to see that American business is given a chance to create jobs after the war, be revising the excess profits tax so as to leave the "seed money."

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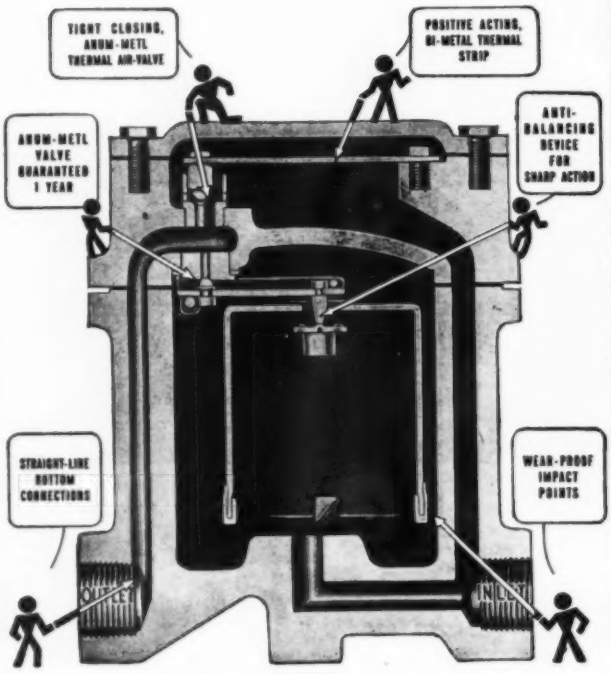

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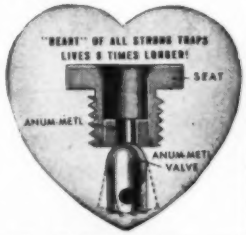

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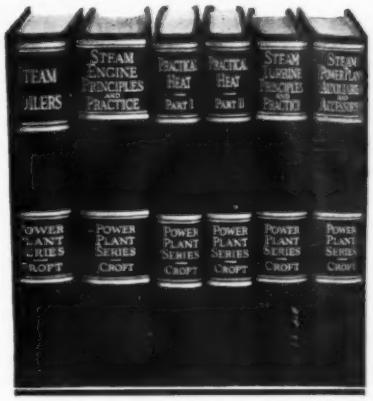

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*** MECHANICAL ENGINEERING ***

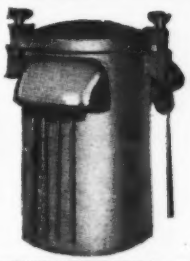
Also furnishing power plants, industrial, municipal and private, plants, designed, appraised or built, complete or parts, steam or other fuels, boilers, engines, pumps, machine and manufacturing plants also, new or used equipment.

P. O. BOX 236

Oklahoma City, — Oklahoma

WANTED

—TRANSFORMERS—



TRANSFORMERS WANTED

in operating condition or burnt out. Mail us list giving complete nameplate data and stating condition.

We Rewind, Repair and Redesign all Makes and Sizes
ALL TRANSFORMERS GUARANTEED FOR ONE YEAR
We will be pleased to quote prices on request.

THE ELECTRIC SERVICE CO., INC.

"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
STATION M — Since 1912 — CINCINNATI, OHIO

DIESEL ENGINES

WANTED

1500 HP in one or more units with or without Generators. Single unit preferred. Give full information.

W-506, Power
330 West 42nd St., New York City

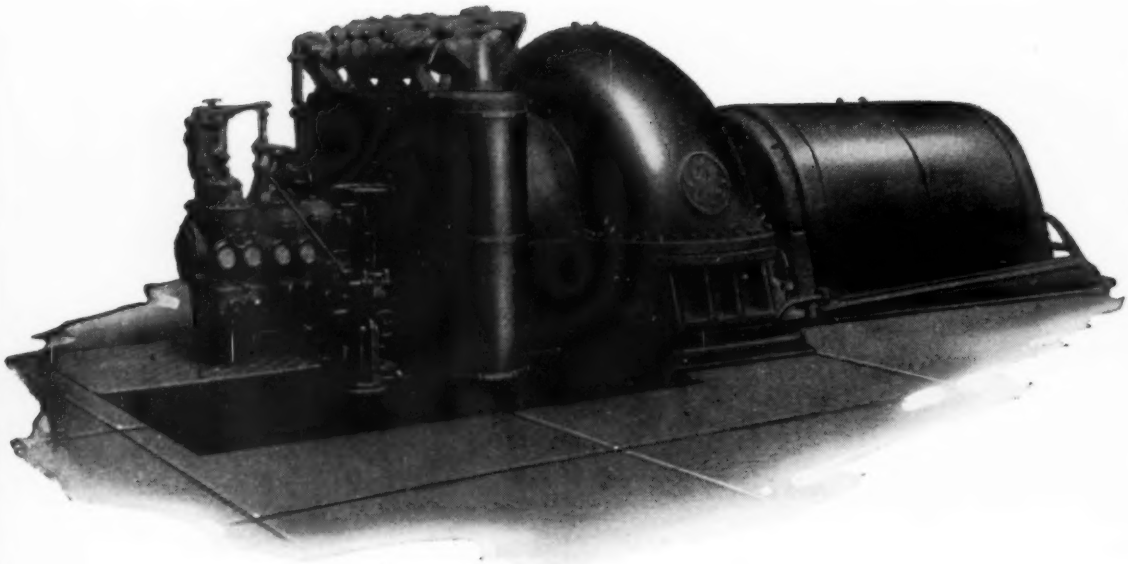
WANTED

GAS ENGINE

1—90 H.P., 4 cylinder, 10x11 Bruce MacBeth gas engine, type serial number around 600-700. Reply

W-503, Power
330 West 42nd St., New York City

ELECTRICAL POWE



Actual Photograph

3125 KVA GENERAL ELECTRIC CONDENSING TURBO UNIT

3125 KVA General Electric Alternating current generator, 3 phase 60 cycle 2400/4160 volts 3600 RPM direct connected to General Electric condensing turbine 225-400 lbs. steam pressure 700 deg. TT. Equipped with surface condenser and auxiliaries.

ALTERNATING CURRENT TURBO GENERATORS

3 Phase 60 Cycle

9375 KVA GENERAL ELEC- TRIC condensing, 225 lbs. pressure, 100 deg. superheat, 1800 RPM with surface condenser; 4800 volts.

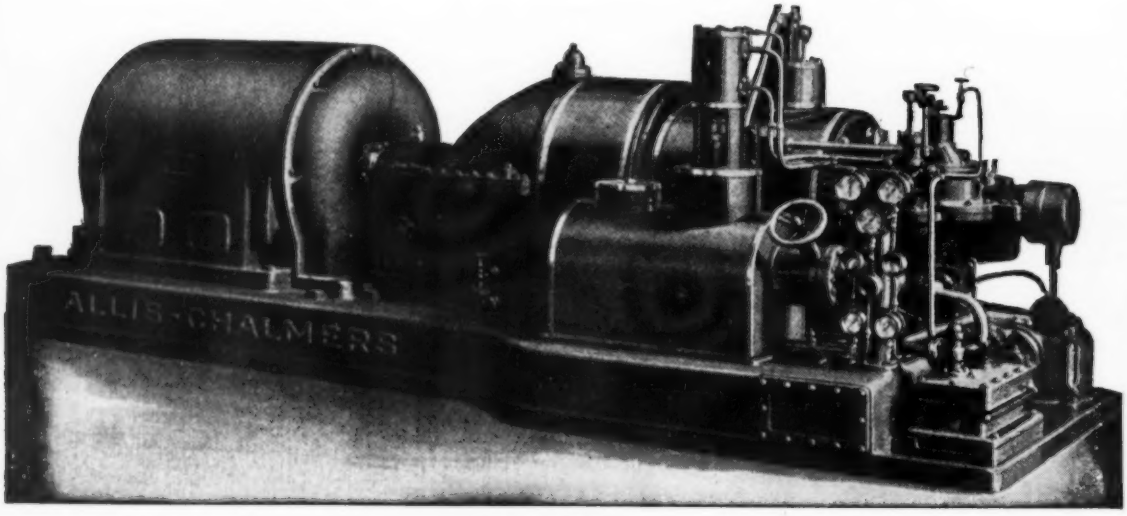
6250 KVA GENERAL ELEC- TRIC condensing, 220-22 lbs. pressure, 100 deg. superheat, 3600 RPM with jet condenser; 2300 volts.

3125 KVA GENERAL ELEC- TRIC condensing, 225-400 lbs. pressure, 700 deg. TT, 3600 RPM with surface condenser; 2300/4160 volts.

1250 KVA ALLIS CHAL- MERS condensing, 150-200 lbs. pressure, 100 deg. superheat, 3600 RPM with jet condenser; 2300 volts.

SURFACE CONDENSER

1540 sq. ft. WORTHINGTON surface condenser with steam jet air pumps.



Actual Photograph

1250 KVA ALLIS CHALMERS CONDENSING TURBO UNIT

1250 KVA Allis Chalmers alternating current generator 3 phase 60 cycle 2300 volts 3600 RPM direct connected to Allis Chalmers condensing turbine 150-200 lbs. steam pressure 100 deg. superheat. Equipped with jet condenser and auxiliaries.

ALTERNATING CURRENT ENGINE GENERATORS

3 Phase 60 Cycle

1000 KVA WESTING- HOUSE-SKINNER uniflow 125-150 lbs. steam pressure, 0-8 lbs. back pressure, 150 RPM; 480 volts.

438 KVA GENERAL ELEC- TRIC - SKINNER uniflow 125-150 lbs. steam pressure, 0-5 lbs. back pressure, 150 RPM; 2300-600-480-240 volts

375 KVA WESTING- HOUSE-SKINNER uniflow 125-150 lbs. steam pressure, 0-5 lbs. back pressure, 200 RPM; 480 volts.

210 KVA GENERAL ELEC- TRIC - SKINNER uniflow 120-150 lbs. steam pressure 0-3 lbs. back pressure, 225 RPM; 2300-600-480-240 volts

210 KVA GENERAL ELEC- TRIC, 2300-600-480-240 volts, 225 RPM (GEN- ERATOR ONLY)

THE NATIONAL POWER

ER EQUIPMENT

ROTARY CONVERTERS

60 Cycle

500 KW (2) WESTINGHOUSE, 225-285 volts D.C., 225 RPM with 3 phase 60 cycle 13200 volt transformers.

500 KW WESTINGHOUSE, 225-285 volts D.C., 450 RPM with 3 phase 60 cycle 2300/4000-6900/12000 volt transformers.

750 KW GENERAL ELECTRIC, 600 volts D.C., 1200 RPM with 3 phase 60 cycle 2300/4000 volt transformers.

MOTOR GENERATORS

60 Cycle

500 KW GENERAL ELECTRIC, 600 volts D.C., 3 phase 60 cycle 4150 volts A.C., 720 RPM.

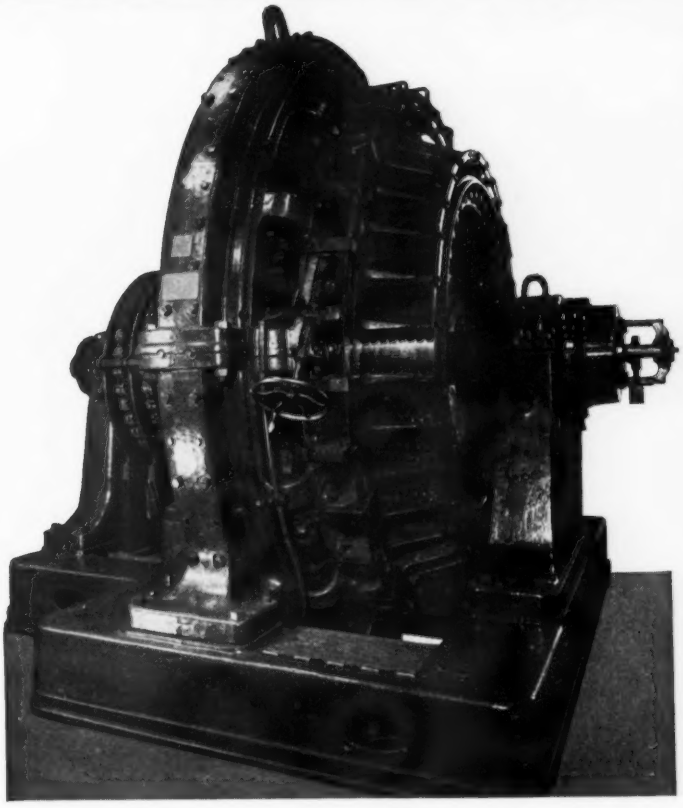
000 KW GENERAL ELECTRIC, 3-unit, 125 volts D.C., 3 phase 60 cycle 4000/2300 volts A.C., 720 RPM.

ROTARY CONVERTERS

25 Cycle

500 KW WESTINGHOUSE,, 600 volts D.C., 500 RPM with 3 phase 25 cycle 11000 volt transformers.

000 KW Westinghouse, 225 - 285 volts D.C., 300 RPM with 3 phase 25 cycle 9000 volt transformer.



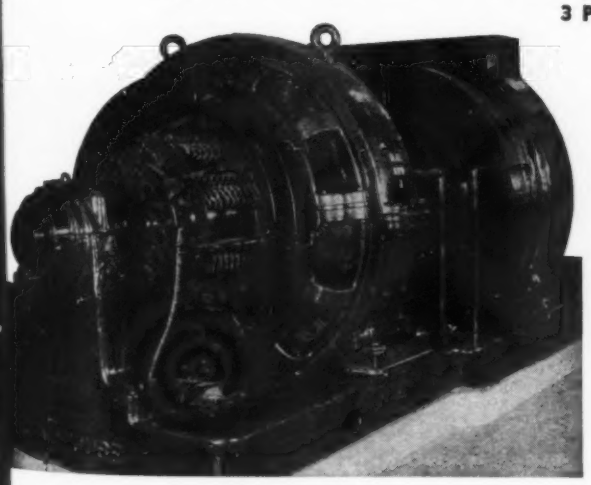
3500 KW (2) Westinghouse booster type interpole, rotary converters, 225-285 volts D.C. 225 RPM; 6 phase 60 cycle A.C. with 3 phase 60 cycle 13,200 volt transformers. Complete with control.

Actual Photograph

3500 KW WESTINGHOUSE ROTARY CONVERTER

MOTOR GENERATOR SETS

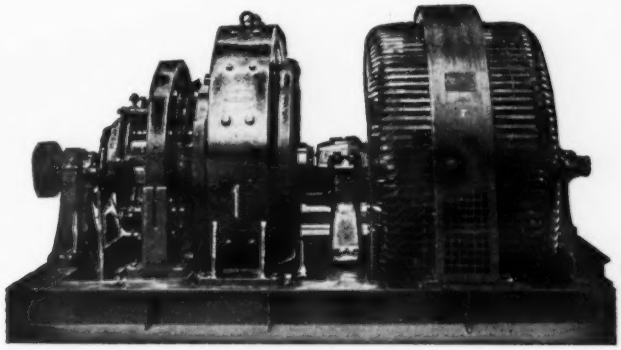
3 Phase 60 Cycle



Actual Photograph

1000 KW WESTINGHOUSE MOTOR GENERATOR SET

00 KW (1500 KW 2 hrs. 55 deg. C rise) WESTINGHOUSE direct current enerator 125/250 volts 3-wire 720 RPM direct connected to 1427 HP 80% .F. (2140 HP 2 hrs. 55 deg. C rise) WESTINGHOUSE synchronous motor 3 hase 60 cycle 2300 volts 720 RPM. Equipped with D.C. control panel and arting equipment.



Actual Photograph

1000 KW GENERAL ELECTRIC MOTOR GENERATOR SET

1000 KW (1250 KW 2 hrs. 55 deg. C rises) GENERAL ELECTRIC direct current generator 125/250 volts 3-wire 720 RPM direct connected to 1400 HP 80% P.F. (1750 HP 2 hours 55 deg. C rise) GENERAL ELECTRIC synchronous motor 3 phase 60 cycle 13200/6600 volts 720 RPM. Equipped with D.C. breakers.

R MACHINERY CO. 1921 SCRANTON RD. CLEVELAND, OHIO

1500 KW MOTOR GENERATOR SET

AVAILABLE IMMEDIATE DELIVERY

1—ALLIS CHALMERS Motor Generator Set consisting of:

1500 KW, 600 Volt Direct Current Generator Direct Connected to a 2190 HP, 3 Phase, 60 Cycle, 4000/6600 Volts, 300 RPM Synchronous Motor.

TURBINE-GENERATOR UNITS

3 phase, 60 cycles

6250 KVA Westinghouse condensing 175-200 lb. pressure, 2300 volts, complete with surface condenser and auxiliaries.

3125 KVA Westinghouse 180-200 lb. pressure, 500° T.T. 2300 volts, 3600 RPM equipped with surface condenser, condensing auxiliaries, exciter unit, switchboard with instruments—(a complete installation).

1563 KVA G.E. condensing 175-200 lb. pressure 500° T.T., 2300 volts, 3600 RPM, complete with surface condenser and condensing auxiliaries.

1250 KVA ALLIS condensing 150-200 lb. pressure, 100° superheat, 2300 volts, 3600 RPM, complete with Wheeler surface condenser.

937 KVA G.E. condensing 200 lb. pressure, 100° SH, 2300 volts, 3600 RPM complete with condenser, exciter, switchboard and instruments.

937 KVA Allis condensing 200 lb. pressure, 100° superheat, 2300/550/480 volts, 3600 RPM complete with direct connected exciter, and either with a surface or jet condenser. Modern.

937 KVA ALLIS condensing 150 to 200 lb. pressure, 475° TT, 2300 volts, 3600 RPM, complete with direct connected exciter, surface condenser and auxiliaries.

750 KVA G.E. condensing 150-200 lb. pressure, 2300 volts, 3600 RPM, complete surface condenser and exciter set.

625 KVA G.E. condensing 200 lb. pressure, 2300 volts, 3600 RPM, complete with condenser and auxiliaries.

TURBINE-GENERATOR UNITS (Con't.)

375 KVA G.E. condensing 150-200 lb. pressure, 100° superheat, 2300 volts, 3600 RPM, complete with surface condenser auxiliaries.

375 KVA (2) G.E. non-condensing 150-175 lb. pressure, 5 lb. back pressure, 2300 volts, 3600 RPM each complete with direct connected exciter and rheostats.

125 KVA G.E. non-condensing, 125-150 lb. pressure, 10 lb. back pressure, 240 volts, 3600 RPM, with direct connected exciter and switchboard.

ENGINE-GENERATOR UNITS

3 phase, 60 cycle—Alternating Current

500 KVA G.E. 240/480 volts, 150 RPM direct connected 26"x32" Skinner, Universal Unaflow non-condensing engine, 130-160 lb., 6 lb. back pressure, complete exciter and rheostats.

438 KVA General Electric 2300 volts, 200 RPM alternating current generator direct connected to Busch Sulzer vertical full Diesel engine.

312 KVA Elliott 4000/2300/550 or 240 volts, 180 RPM direct connected to 17" x 24" Elliott Unaflow non-condensing engine, 175 lb. pressure, 6 lb. gauge back pressure.

300 KVA G.E. 240 volts, 120 RPM direct connected 18"x 36" Hamilton Corliss engine, 125-150 lb. pressure, 5 lb. gauge back pressure, complete exciter, switchboard and instruments.

135 KVA General Electric 2300 volts, 277 RPM alternating current generator direct connected to Busch Sulzer *vertical full Diesel engine.*

ENGINE-GENERATOR UNITS

Direct Current

1000 KW Westinghouse, 250 volts, 514 RPM direct current generator direct connected through reduction gear to Westinghouse condensing turbine, 150-200 lbs. pressure, equipped with Westinghouse surface condenser, switchboard and instruments.

600 KW Crocker - Wheeler 250 volts, 300 RPM direct connected to a 14" x 18", 4 cylinder Ames vertical Unaflow non - condensing engine, 150 to 175 lb. pressure, 5 lb. gauge back pressure complete switchboard and instruments.

300 KW WESTINGHOUSE 250 volts, 175 RPM direct connected 24"x26" Skinner Unaflow non - condensing engine, 110-150 lb. pressure, 5 lb. back pressure, complete switchboard and instruments.

150 KW Crocker-Wheeler, 125 volts, 200 RPM direct connected to an Erie Ball single cylinder, 4-valve, non-releasing Corliss engine complete with switchboard.

50 KW General Electric, 125 volts, 1200 RPM direct connected 75 HP Terry non - condensing turbine, 150 lb. pressure, 15 lb. back pressure, complete with switchboard.

MOTOR GENERATOR SET

100 KW Electric Machinery 125 volt direct current direct connected to 150 HP, 3 phase, 60 cycle, 440 volt, 1200 RPM synchronous motor complete with switchboard equipment.

MOTORS

3 phase, 60 cycle

625 HP G.E. type ATI, 2200 volts, 257 RPM synchronous

620 HP G.E. type ATI, form S, 440 volt, 164 RPM synchronous.

300 HP, 80% P.F. WESTINGHOUSE 2300 V., 200 RPM synchronous.

150 HP (5) G.E., form K, 2200 volts, 580 RPM, in the 4 million series, each complete with G.E. automatic compensator.

125 HP 80% P.F. Elec. Mchy. 440 V., 400 RPM synchronous with starting equipment.

50 HP, type 1, form M, 3 phase, 60 cycle, 2200 volts, 1200 RPM slip ring.

50 HP Allis-Chalmers, 440 volts, 600 RPM squirrel cage.

MISCELLANEOUS

1500 KVA, 3 phase, 60 cycle, 22,000 volt primary, 2300 volt secondary WESTINGHOUSE transformer.

500 KVA IDEAL, 3 phase, 60 cycle, 240 volts, 400 RPM, three-bearing belted type generator with direct connected exciter and rheostats.

312 KVA WESTINGHOUSE, 3 phase, 60 cycle, 2300 or 220 volts, 200 RPM, engine type generator with belt driven exciter and rheostats.

300 KVA General Electric, 3 phase, 60 cycle, 440 volts, 600 RPM, three bearing belted generator complete with switchboard.

200 KVA WESTINGHOUSE, 3 phase, 60 cycle, 240 volts, 200 RPM engine type generator with rheostat.

1 ELLIOTT EHRHART jet condenser with all auxiliaries suitable for operation with a 5000 KW turbine-generator unit.

1055 cubic feet. 100 lb. air-pressure CHICAGO PNEUMATIC horizontal compressor direct connected to 170 HP, 240 V., 150 RPM General Electric direct current motor.

512 HP Babcock & Wilcox Sterling 4-drum water tube boiler code construction, 200 lb. pressure, single setting complete with stoker.

30 KW G.E., 125 volts, 625 RPM, type RC compound wound direct current generator.

Synchronous condensers 1350 KVA total capacity

750 KVA and 600 KVA, General Electric type ATI, 3 phase, 60 cycle, 240 volts, 900 RPM synchronous condensers.

Each unit is complete with direct connected exciter, switchboard panel with instruments.

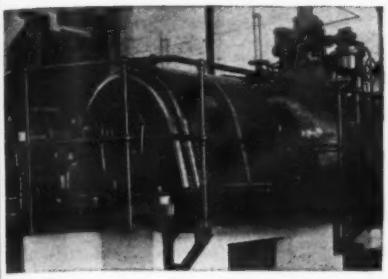
Are in A#1 operative condition — still on original foundation for operating test.

Utilities Electrical Machinery Corporation

600 NATIONAL CITY BANK BLDG.
CLEVELAND, OHIO

WIRE OR PHONE
LONG DISTANCE 422

FIRST AID TO THE PLANT THAT NEEDS POWER FOR PRODUCTION!



MOTORS—D. C. 230 VOLTS

1—250 HP, 760 RPM, Electro Dynamic.
1—150 HP, 750 RPM, Electro Dynamic.
1—125 HP, 600 RPM, Westinghouse, SK.
1—100 HP, G.E. 575 RPM.
1—100 HP, 625 RPM, G.E.
1—90 HP, 900 RPM, G.E.
1—75 HP, 950 RPM, G.E.
1—65 HP, 1000 RPM, G.E., type RC.
1—50 HP, 750 RPM, Westinghouse, type SK.
1—50 HP, 700 RPM, Crocker Wheeler.
1—40 HP, 775 RPM, Westinghouse.
1—40 HP, 300 RPM, General Electric.
1—30 HP, 750 RPM, G.E., type RC.

MOTORS—VARIABLE SPEED 230 VOLTS

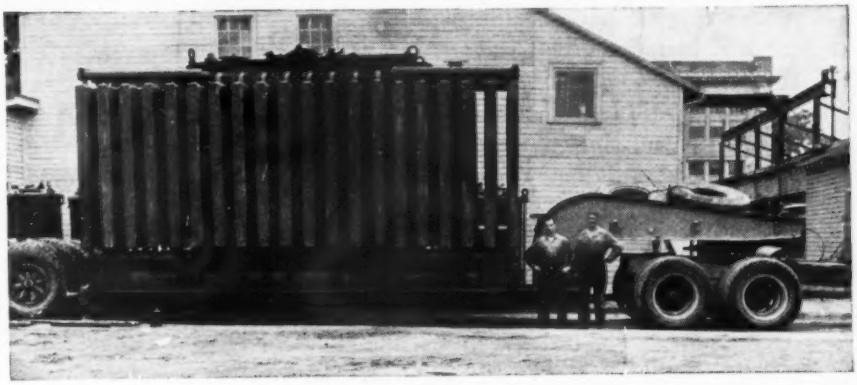
2—100 HP, 475/1375 RPM, Electro Dynamic.
1—90 HP, 470/940 RPM, General Electric.
1—75 HP, 525/1575 RPM, Electro Dynamic.
1—60 HP, 600/1200 RPM, General Electric.
1—35 HP, 500/1500 RPM, Westinghouse.
1—35 HP, 350/1050 RPM, Electro Dynamic.
1—30 HP, 225/900 RPM, Crocker Wheeler.
2—25 HP, 300/900 RPM, Electro Dynamic.
1—20 HP, 750/1500 RPM, General Electric.
1—15 HP, 300/1200 RPM, G.E.
1—13/18 HP, 350/1200 RPM, Electro Dynamic.
1—5 HP, 600/1200 RPM, General Electric.
1—5 HP, 450/1800 RPM, Crocker Wheeler.
1—5 HP, 400/1600 RPM, Diehl.
1—5 HP, 225/900 RPM, Electro Dynamic.

MOTORS GENERATOR SETS

1—20 KW, 600 volt, GE, sq. cg.
2—250 KW, 250 v., GE Synch.
2—200 KW, 125 v., Wsgh., Sq. Cage
1—100 KW, 125 v., GE Sq. Cage
1—50 KW, 250 v., Wsgh., Sq. Cage

MOTORS—3 PHASE 60 CYCLE

1—720 HP, 360 RPM, 440 volt, G.E., syn.
1—500 HP, 1200 RPM, 440 volt, GE, syn.
1—400 HP, 514 RPM, 440 volt, Westg., slip ring.
1—325 HP, 600 RPM, 2300 volt, GE, syn.
1—300 HP, 720 RPM, 2200 volt, G.E., Sl. Rg.
1—250 HP, 514 RPM, 4000 volt, G.E., syn.
1—250 HP, 600 RPM, 4000 volt, G.E. Sync.
1—200 HP, 900 RPM, 440 volt, Westg., sl. rg.
1—200 HP, 600 RPM, 2200 volt, G.E., sl. rg.
1—200 HP, 450 RPM, 2200/4000 v., G.E., sl. rg.
1—150 HP, 1800 RPM, 2300 volt, Al. Ch. sq. cg.
1—150 HP, 900 RPM, 440 volt, Al. Ch. sl. rg.
1—150 HP, 720 RPM, 440 volt, G.E., slip ring.
1—150 HP, 600 RPM, 440 Volt, G.E., slip ring.
1—150 HP, 400 RPM. 440 volt, G.E., sq. cg.
1—125 HP, 720 RPM, 440 volt, G.E., slip ring.
1—100 HP, 900 RPM, 440, Westinghouse, sq. cg.
1—100 HP, 900 RPM, 440 volt, G.E., slip ring.
1—100 HP, 720 RPM, 440 volt, G.E., slip ring.
1—100 HP, 720 RPM, 440 volt, G.E., sq. cg.
1—100 HP, 600 RPM, 440 volt, G.E., slip ring.
1—100 HP, 600 RPM, 440 volt, G.E., sq. cg.
1—100 HP, 514 RPM., 440 volt, G.E., sq. cg.
1—100 HP, 450 RPM, 440 volt, G.E., sq. cg.
1—80 HP, 400 RPM, 550 volt, Cr. Whlr, sq. cg.
1—75 HP, 900 RPM, 4000 volt, Elec. Mach. syn.
1—75 HP, 900 RPM, 220 volt, Fairbanks, Morse, slip ring.
1—75 HP, 900 RPM, 440 volt, GE, sq. cg.
1—75 HP, 720 RPM, 440 volt, Westghse, slip ring.
1—75 HP, 720 RPM, 440 volt, GE, sq. cg.
1—50 HP, 900 RPM, 440 volt, GE, slip ring.
1—50 HP, 900 RPM, 440 volt, GE, sg. cg.



15,000 KVA Transformers for National Defense

TRANSFORMERS

2—400 KVA, G.E., 4156-240/480 v., Scott taps.
3—300 KVA, Pittsburgh, 7800/440 volts.
3—250 KVA, Westinghouse, 5500/440 volts.
2—200 KVA, GE, 2300/4600-230/460 volt, Scott taps.
1—209 KVA, Pittsburgh, 7800-110/220 volts
3—150 KVA, G.E., 33,000 2300/4000 Y.
1—150 KVA, G.E., 2400-120/240 volts.
3—100 KVA, Westinghouse, 11,430/250 volts.
1—100 KVA, Pittsburgh, 1375/2750-110/220 volts.
1—100 KVA, G.E., 2200-110/220 volts.
3—100 KVA, Westinghouse, 13200 250 volts.
3—75 KVA, G.E., 13,500-7500/440 volts.
1—75 KVA, G.E., 3 phase, 4156Y-120/208Y.
1—75 KVA, Pittsburgh, 7600-110/220 volts.
3—50 KVA, Wagner, 4150-220 volts.
2—50 KVA, Pbgh. 7500/15,000 volts-110/220 volts.
4—37½ KVA, 2200-220/110 v.
7—25 KVA, Westg., air cooled, 440/220-110 v.
1—25 KVA, G.E., 220/110-220/110 volts.
2—15 KVA, G.E., 2300-115/230 volts.
4—10 KVA, G.E., 2300-115/230 volts.
3—7½ KVA, G.E., 440-110/220 volts.

ALTERNATORS

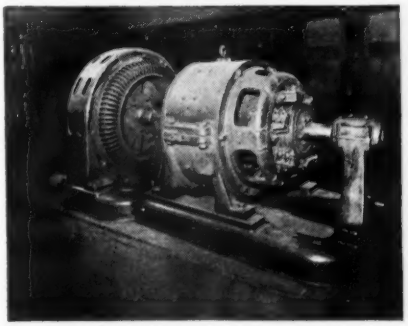
1—625 KVA, 3600 RPM, 600 volt, G.E.
1—400 KVA, 400 RPM. 240 volt, Westg.
1—250 KVA, 720 RPM, 230 volt, G.E.
1—200 KVA, 3600 RPM. 240 volt, Allis Chal.
1—62½ KVA, 3600 RPM, 220 volt, Allis Chalmers.

TURBO-GENERATORS

600 KW Terry dual bleeder condensing Turbine only.
1—500K W, G.E., 3 ph., 60 cy., 480 volt, bleeder.
1—375 KVA, Westinghouse, non-condensing.
1—300 KW, G.E., 3 ph., 60 cy., 220 volt, cond.
1—200 KW, G.E., 3 ph., 60 cy., 220 volt, cond.

OIL CIRCUIT BREAKERS

1—3000 amp., 15,000 v., 3 pole, G.E., type FK-130.
1—3000 amp., 600 v., 4 pole, G.E., type FK-24.
1—1600 amp., 7500 v., 4 pole, Westg., B-2.
1—1200 amp., 15000 v., 4 pole, Westg., B-2.
Also complete stock of small sizes.

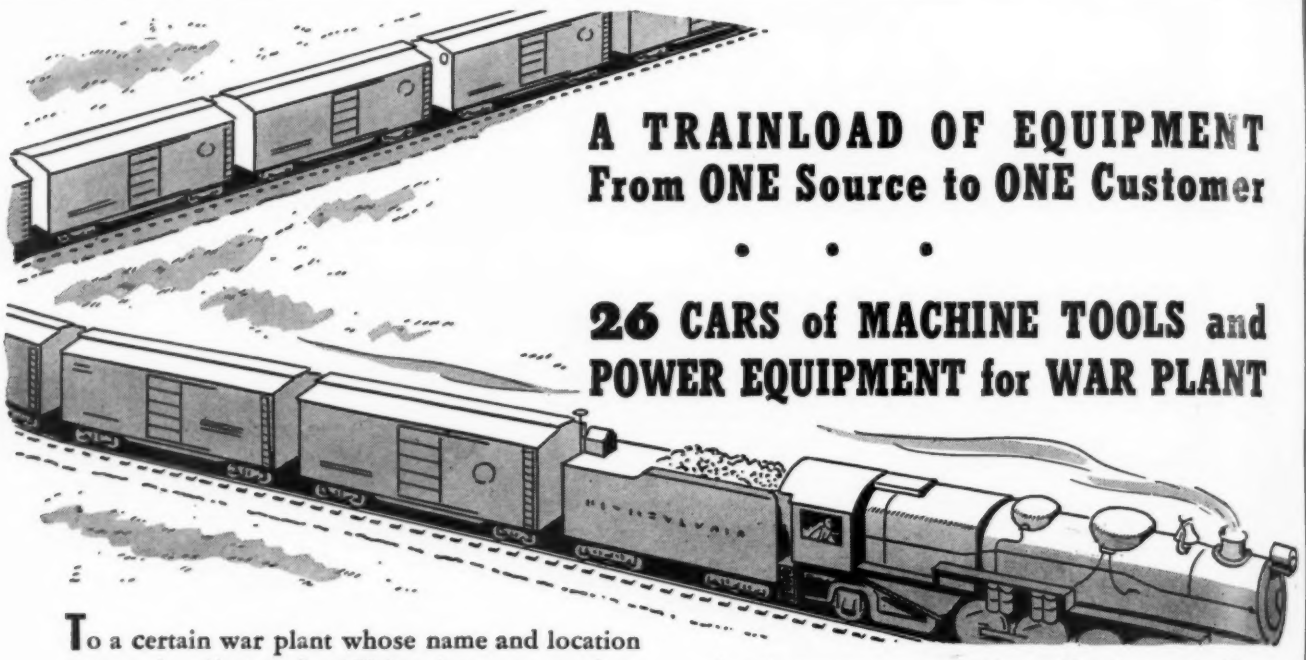


POWER EQUIPMENT FOR FIGHTING EQUIPMENT

HEMPHILL

J L HEMPHILL & CO..1602 53rd ST NORTH BERGEN N.J.

★ ★ Phone New York — Longacre 5-3227 New Jersey — Union 3-2600 ★ ★



A TRAINLOAD OF EQUIPMENT
From ONE Source to ONE Customer

• • •

26 CARS of MACHINE TOOLS and POWER EQUIPMENT for WAR PLANT

To a certain war plant whose name and location cannot be disclosed, O'Brien last year made a record shipment—26 carloads of machine tools and equipment at one time. Included in this trainload were planers, boring mills, slotters, drill presses, straightening rolls, milling machines, grinders, plate planers, punches, shears, lathes, bolt cutters, screw machines, turret lathes, and all electric motors to special specifications; shafting, hangers, pulleys, belting; boilers, air compressors, pumps—literally everything to put the plant in operation. This buyer not only received at one time equipment almost impossible to pick up from many different sources, but he saved months of precious time.

PLACE YOUR ENTIRE ORDER WITH O'BRIEN

Selection from current offerings—subject to prior sale

A. C. TURBINE UNITS

4000 KVA Al. Ch. Cond., 3/60/2300/3600 RPM.
3125 KVA G. E.—Curtis Cond., 3/60/2300/3600 RPM.
2500 KVA West. Cond., 3/60/600/3600 RPM.
937 KVA Al. Ch.—Moore Bleeder type, non-cond., 3/60/480/3600 RPM, 75# bleed.
625 KVA G. E.—Curtis Cond., 2/60/2300/3600 RPM.
625 KVA West. Non-cond. geared, 3/60/2300 volt, 6000/900 RPM.
500 KVA West. Cond., geared, 3/60/2400 volt, 6000/900 RPM.
375 KVA West. non-cond., geared, 3/60/2400 volt, 6000/900.
375 KVA G. E. cond., 3/60/240/3600 RPM.
187 KVA West. non-cond., geared, 3/60/2300 volt, 7200/900.
75 KVA Al. Ch.—DeLaval, non-cond., 3/60/240/3600 RPM.

MOTOR GENERATOR SETS

1000 KW General Electric 3-unit Set with 2—500 KW, 150 volt D.C. Generators, 1400 HP Synchronous 3 phase, 60 cycle, 4000 volt, 514 RPM.
275 KW Allis-Chalmers 3-unit Set, 450 RPM—
150 KW Gen., 150 volt, and 125 KW Gen., 240 volt.
400 HP Syn. Motor, 3/60/4500 volt.
150 KW Gen. Elec. type MP, 250 volt, 514 RPM, 200 HP Syn., 3/60/2300.
2—150 KW Westinghouse Rotary Converters, 250 volt, 6 phase, 1200 RPM with O.C.Bs. and Transformers, 2300/3/60.
100 KW Gen. Elec. 125/250 volt 1200 RPM, 3/60/440.
100 KW General Electric, 125 volt, 900 RPM, 2/3 phase, 60 cycle, 220 volt.
2—75 KW Westinghouse, 250 volt, 3 phase, 60 cycle, 220 volt, 1200 RPM.
75 KW Elec. Mchy. 125 volt 1200 RPM, 112 HP Syn., 3/60/2200.
50 KW Gen. Elec., 125 volt, 3 phase, 60 cycle, 2200 volt, 720 RPM.
35 KW Fairbanks-Morse 250 volt 60 HP Syn. Motor, 3/60/220/1200 RPM.
25 KW Westinghouse, 125 volt, 1200 RPM, 3/60/220 volt.

MARINE GENERATOR SETS—115 VOLT D. C.

1—15 KW Gen. Elec. vertical automatic Steam Engine, 350 RPM.
2—25 KW Westinghouse geared Turbine Sets, 1200/5000 RPM.
4—35 KW Gen. Elec. type CC, Steam Turbine Sets, 3600 RPM.
1—35 KW Westinghouse vert. Steam Engine Set, 350 RPM.
1—100 KW Westinghouse Steam Turbine Set, 2400 RPM.

A. C.—STEAM ENGINE UNITS—D. C.

(2)—300 KW Skinner Uniflow, 250 volt D.C., serial over 10,000.
250 KW G. E. 3/60/220/440/2300, 200 RPM; direct con. Chuse-Ridgeway Uniflow, non-cond. Phila. warehouse stock.
50 KVA West. 3/60/220/440/2300, 300 RPM; Harrisburg Fleming piston valve, automatic Engine. Phila. stock.

We are also representatives in the Phila. area for many of the leading national manufacturers of new machinery

Everything from a Pulley to a Power House

THE O'BRIEN MACHINERY CO.

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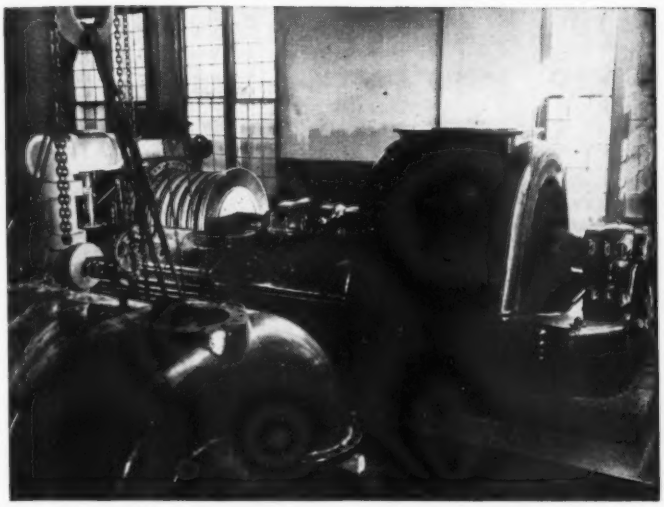

7500 Kw Condensing Turbo-Alternator

7500 KW 80% Curtis General Electric 6-stage Reaction Pattern Condensing Turbo (in record log service performing at 10/11000 KW.) Unit is 60/3/5000/1800 RPM/200# 150° Superheat (has been operated standardly under 250# ISP). Steel steam chest and throttle valve; generator mica insulated. Standard operating temperature rated 40°C. Wheeler Surface Condenser equipped.

CONDITION: In personal disassembly inspection accompanied by parent experts, recently completed, the fact of quality almost equal to new has been verified.

TURBOS—60 cycles

15000 KW performance 40° Impulse and Reaction Semi-Double Flow Condensing unit with non-automatic bleeder facility, 200# design (approved and adaptable with slight changes for 400# and non-automatic in max. volume at either 100# or 65# GPB (single parallel theory for 2300 volts). Surface Condenser and all auxiliaries complete. "In RANGE".

4000 KVA Allis-Parsons design Turbo 60/3/4150 volts Star (perhaps regroupable standard theory 2300 volts Delta). Original design Condensing and operated at 5000 KW for short period, then altered for NC heating by-process load after removal of 4 rows LP blades (would require new blading for condensing). Now Surface Condenser equipped with all standard auxiliaries.

2000 KW rated Allis-Parsons (approx. 3000 KW normal) 60/3/440, no Condenser (would operate efficiently at approx. rated log NC plan at approx. 18# GP).

2000 KW GE Curtis 6-stage Reaction design 60/3/2300/1800 RPM Condensing and Non-Automatic Bleeder, Surface Condenser equipped. Has log record of 2600 KW constant at 40°. Total log service record 8000 hours (approved non-automatic bleeder theory 30,000# 20# BP. 1800/2000 KW performance.

2000 KW Westinghouse Reaction design 60/3/2300/1800 RPM. Now Barometric Condenser equipped. Officially approved for NC plan at minimum 1500 KW 18# BP. Operators vouch for first-class condition thruout.

TURBOS—25 cycles

50,000 KW total aggregate capacity—In unit sizes of 3000 to 6000 KW—Complete sets with Surface Condensers—First Class Condition.

SURFACE CONDENSERS

Surface condenser units complete in following general capacity range 20,000 sq. ft., 15,000, 12,000, 11,000 and 8,200 sq. ft. Also other smaller units.

WATER TUBE BOILERS

200,000#/HOUR TOTAL STEAM GENERATION PLANT.

150,000# per hr STEAM GENERATION UNIT

650# ASME PROPER 450#, 700 DEGREE TT, 4 DRUM, BENT TUBE, NEW EQUIVALENT, SUPERHEATER EQUIPPED WATERWALLS.

6—1050 HP BOX STEEL HEADER 200# 150° SUPERHEAT—CHAIN GRATE STOKER—APPROVED FOR 200# ERECTION COMPLETE BOILER PLANT LAYOUT.

8—400 HP B&W STIRLING 200# ASME POWDERED COAL FIRED, SUPERHEATERS, SOOT BLOWERS, FORCED DRAFT FANS, FEEDWATER HEATERS, COAL AND ASH HANDLING, METERS, GAUGES, ETC.,—STEEL BUILDING CAPABLE OF DISMANTLING—SHORT LOG SERVICE—200# APPROVED—RECENT INSPECTION.

2—750 HP 200# 100° EDGEMOOR ASME BOX HEADER HORIZ. STRAIGHT TUBE INDUCED DRAFT FANS.

1—1400 HP 650# 200° BENT TUBE COAL FIRED EQUIVALENT BRAND NEW.

4—500 HP B&W Sectional Header 180#.

4—500 HP B&W Stirling 200# ASME—Pulverizers.

Approximately 12 Smaller Straight Tube and Bent Tube Boilers 200#—350/500 HP.

PIONEER PERSONAL SERVICE COOPERATION IN HEAVY POWER

THRU THREE WARS—IN INTEGRITY OF PERFORMANCE

RE-NU-BILT BY BELYEA

MOTOR GENERATOR SETS

3 phase—60 cycle

1—1500 KW G.E. 600 V. Gen. d.c. to 2100 HP 6600 V. Syn.
1—500 KW Whse. 250 V. Gen. d.c. to 700 HP 2300 V. Syn.
1—500 KW Whse. 250 V. Gen. to 700 KVA, 6600 V. Syn.
1—500 KW G.E. 600 V. Gen. to 700 HP 2300 V. Syn.
1—150 KW G.E. 250 V. Gen. to 200 KVA, 440 V. Syn.
1—500 KW G.E. 600 V. Gen. d.c. to 700 HP 13200 V. Syn.
1—500 KW G.E. 600 V. Gen. to 700 HP, 2300 V. Syn.
1—150 KW G.E. 550 V. Gen. d.c. to 225 HP 2300 V. Syn.
1—150 KW G.E. 250 V. Gen. to 200 KVA, 440 V. Syn.
1—125 KW Whse. 250 V. Gen. to 200 HP., 440 V. Sq. Cage
1—100 KW Whse. 250 V. Gen. to 150 KVA, 2300 V. Syn.
1—75 KW G.E. 125 V. Gen. to 125 HP, 2300/4000 V. Sq. Ca.
2—50 KW G.E. 125 V. Gen. to HP, 2300/4000 V. Sq. Ca.

D. C. MOTORS

HP	Make	Type	Volts	Speed
1—1500	Whse.		550	320
2—1250	G.E.	MPC	500	130
1— 800	G.E.	MPC	550	660
2— 625	G.E.	MPC	250	130
1— 600	G.E.	MPC	550	600/800
1— 600	Whse.		230	150/275
1— 350	G.E.	MPC	230	450
1— 300	G.E.	MPC	230	275/550
1— 300	G.E.	MCF	230	400/1000
1— 300	G.E.	MPC	230	250/400
2— 200	Whse.		230	400/500
7— 175	Whse.	SK	250	150/525
2— 150	Whse.	SK	230	300/900
2— 125	G.E.	CO1832	230	625
3— 100	G.E.	LC	230	1200
1— 100	Whse.	SK	230	600
1— 100	Al. Ch.		230	950/1150

A. C. MOTORS

3 phase—60 cycle

SLIP RING

HP	Make	Type	Volts	Speed
2—1200	Cr.Wh.	801Q	2300	257
1— 800	Al.Ch.	ANY	440	885
1— 600	G.E.	IM	2200	900
1— 500	G.E.	I-M	440	400
1— 450	Whse.	HW	2200	875
1— 400	Al.Ch.	ANY	440	1200
1— 400	G.E.	MT	550/440	300
1— 400	Al. Ch.	ANY	2300	505
1— 350	G.E.	MT-442	2300/4000	257
1— 300	G.E.	I-M	440	720
1— 300	Whse.	CW	2300	620
1— 250	G.E.	MR	2300	300
1— 350	G.E.	MT	400/2300	230
1— 250	G.E.	MT-410	2300	300
2— 200	Whse.	CW	2200	514
2— 200	G.E.	IT-M	2200	1730
2— 175	G.E.	IE-15A	2200	800

SQUIRREL CAGE

HP	Make	Type	Volts	Speed
1—500	G.E.	1-17B	2200	600
1—400	Whse.	CS	2200	585
1—300	Whse.	CS	550	980
1—300	G.E.	IK	440/2300	600
1—250	Al.Ch.		220/440	1150
1—200	G.E.	IK	2200	400
1—200	Whse.	CS	4600	900
2—200	Whse.	CS	2300	1200
1—200	Whse.	CS	440	580
1—150	Al.Ch.	AN	220/440	1730

ROTARY CONVERTERS

60 cycle

1—1500 KW Whse. 720 RPM 650 V. D.C. with transformers 11500 V. and panels.
1—1250 KW G.E. 720 RPM 250 V. D.C. with transformers 2300 V. and panels.
2—1000 KW, Whse., 900 RPM, 600 V. D.C. with transformers 2200 V. and panels.
1—750 KW, Whse. 900 RPM, 250 V., D.C., with transf. 11,500/6600/2300 V.
2—750 KW Whse. 1200 RPM 600 V. D.C. with transformers 2300/6600 V. and panels.
1—500 KW, Whse, 900 RPM, 250 V., D.C., with transf. 13,200/6600/2300 V.
3—375 KW, Whse., 1200 RPM, 250 V. D.C., with transf., 2300 V.

25 cycle

3—1500 KW G.E. 500 RPM 225/275 V. D.C. Booster type with 13,200/6600 V. transformers and panels. **Actual photo** of one at right side **center cut.**
1—500 KW G.E. 750 RPM 225/275 D.C. Booster type with 6600 transformers and panels.

TURBO GENERATOR SETS

1—500 KW Whse. 625 Kva. 440 V. 3 ph. 60 cy. 3600 RPM with Parsons 145/175 lb. condensing turbine complete with jet condenser and accessories.

1—500 KW G.E. 625 Kva 2300 V. 3 ph. 60 cy. with Curtis 4 stage 150 lb. condensing turbine with condenser and accessories.

1—75 KW Ridgeway 250 V. D.C. with Terry turbine 180 lb. pressure with 12 lb. back pressure, 2000 RPM.

TRANSFORMERS

60 cycle

KVA	Make	Ph.	Type	Voltages
1—1500	Whse.	3	OISC	26400/13200/4400
3—1000	G.E.	1	HKDD	13200x2300
3— 300	Pitts.	1	OISC	2300x115/230
2— 333	Pitts.	1	OISE	2400x240
1— 300	Pitts.	3	ODSE	4150x280/120
1— 300	Pitts.	C	ODSE	3150x280/120
3— 300	G.E.	1	H	13200x2300/575
3— 250	Maloney		IC	13800x220/440
2— 200	G.E.		I-HKVD	13800x200/440
3— 150	Whse.		ISK	2200x440/220
3— 200	G.E.	1	HLLD	26400x115/460
3— 150	Whse.	1	SKM	2400x120/240
1— 150	G.E.	3	HT	2300x4000/115
3— 100	Whse.	1	OISC	13200x250
4— 75	Pitts.	1	OISC	2300x575

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43 HOWELL ST., JERSEY CITY, N.J.

REBUILT POWER EQUIPMENT

READY TO SHIP!

ROTARY CONVERTERS

2—200 kw. G.E. 275 v. 900 rpm., 6 ph. 60 cy. complete with overspeed device and transformers.
2—500 kw. G.E. type HC-8 600 volt, 900 rpm., 6 ph., 60 cy. pedestal bearing with overspeed device complete with transformers.

MOTOR GENERATOR SETS

200 kw. Westinghouse 600 v. D.C. 600 rpm., dir. con. 2200/3/60 Syn. Motor Complete.
1—150 kw. Westinghouse 250 v. 600 rpm., dir. con. 2200/3/60 syn. motor.
100 kw. G.E. 550 v. 900 rpm. dir. con. 2200/3/60 Syn. Motor.
1—75 kw. G. E. 250 v. 900 rpm., dir. con. 2300/3/60 Syn. Motor.

ENGINE GENERATOR SETS

225 kw. Elec. Machy. 2200 or 220 v. 2 ph. 60 cy. dir. con. Ideal Steam.
1—225 kw. Elec. Machy. 2200/220 or 440 v. 3 ph. 60 cy., 200 rpm., dir. con. Ideal Engine 4 valve non-releasing.

100 HP. LIDGERWOOD HOIST

Double drum Speedwell 2500 lb. pull at 450' per min. direct driven by 100 hp. A.C. or D.C. Motor.

CHAIN HOISTS

30—2 ton Yale & Towne complete with 3 ton trolleys.

A.C. GENERATORS

219 kva. G.E. 2300/3/60 200 rpm. 80% P.F. Can be reconnected 440 or 220 v.)
2—120 kw. G.E. 220/440 v. 3 ph. 60 cy. 900 rpm., 80% P.F.

GAS ENGINE GENERATOR SET

75 kw. West. 250 v. belted to 110 HP 2 cyl. Bessemer Gas Engine.

SLIPRING MOTORS—3 ph. 60 cy.

No.	HP	Make	Type	Volts	rpm.
1	1500	Allis Chal.	ANY	2200	485
1	700	G.E.	MT-432	2200	393
1	400	West.	CW	2200/550/220	435
1	400	West.	CW-967A	220/440	1170
1	300	G.E.	I-M	220/440	600
1	260	Burke	EMV-65	220/440	600
3	250	G.E.	I-M	550	600
3	250	G.E.	I-M	2200/220/440	600
3	200	G.E.	M	2200/220/440	600
1	200	G.E.	I-M	2200	514
1	150	G.E.	I-M	220/440	900
1	100	West.	CI	220/440	1750
1	100	G.E.	I-M-16	2200	450
2	100	West.	CW	2200	580
1	75	West.	CW	220	875
1	60	West.	HF	2200	690
1	60	Triumph	C-16	220/440	430
2	60	G.E.	MT-536	2200	1150
1	53	G.E.	I-M	220/550	1165
1	52	G.E.	ITC-5013	220/440	570
2	50	Allis Chal.	ANY	220/440	900
1	50	West.	HF-12A	220/440	900
1	50	West.	CW-461	220/440	900
1	50	G.E.		220/440	850
2	50	West.	HF	220/440	1120
1	50	West.	CW-636A	220/440	1150
2	40	G.E.	MT-332	220/440	1155
1	40	G.E.	MTC-5522	220/440	1125
1	40	G.E.	MT-342	220/440	860
1	40	Allis Chal.		220/440	685
1	40	G.E.	MT-552	220/440	575

SYNCHRONOUS MOTORS

2—125 kw. G.E. type ATB, 220/440 v. 3 ph. 60 cy. 900 rpm., 80% PF.

SPEED REDUCER

Qu.	HP.	Make	RPM	Ratio
20	¾	Pgh. Gear	720	52:1
26	¾	Pgh. Gear	840	52:1
30	¾	Pgh. Gear	1200	52:1
5	1	D. O. James	850	24:1
25	1	Pgh. Gear	1800	52:1
2	1	D. O. James	850	55:1
7	2	D. O. James	1200	24:1
1	3	D. O James	1800	55:1
1	3	D. O. James	850	20:1
1	3	Farrell	1160	6:1
2	5	D. O. James	1200	20:1
2	5	Sturtevant	900	14½:1
7	5	D. O. James	1700	24:1
15	5	Tate Jones	720	37:1
1	7½	D. O. James	1750	20:1
3	7½	D. O. James	1200	6.2:1
15	8	Tate Jones	800	36:1
5	10	D. O. James	1200	6.2:1
5	10	D. O. James	840	28:1
20	12	Tate Jones	1200	36:1
3	15	D. O. James	1800	6.2:1
5	15/20	Tate Jones	1700	36:1
2	20	Sturtevant	3700	14.5:1
5	30	Poole Eng.	600	5.5:1
10	40	Poole Eng.	720	5.5:1
4	50	Poole Eng.	900	5.5:1
5	60	Poole Eng.	1200	5 5:1
6	90	Poole Eng	1800	5.5:1
1	150	Falk	1200	7.31:1
1	150	R.D. Nuttal		1.6 1
1	245	Kerr	1200/225	
1	450	Kerr	3800/720	

TRANSFORMERS—1 ph. 60 cy.

3—1500 Kva. Pittsburgh Transformers. 22,000 volt Primary, 6900/6600/2200 volt secondary.

No.	Kva.	Prl.	Sec.	Make	Ph.
1	250	2300	460	G.E.	
3	150	22000	6900	Pgh.	
1	150	2200	230/460	G.E.	3 ph.
1	100	2200	110/220	G.E.	
3	100	6600	550/440/220	Pgh.	
2	75	2200	220	Burke	3 ph.
2	60	440	220/110	West.	
2	50	2300	220/440	G.E.	
3	50	11430/6600	550	Al. Ch.	
3	50	6600	575	G.E.	
1	50	2200	220	Burke	
3	50	2200	110/220	West.	
5	50	2200	110/220	G.E.	
1	37½	2300	220/440	Wagner	
3	37	4400	185	West. (Rotary)	
1	30	2200	110/220	G.E.	
2	30	440	220/110	West.	
25	25	2200	110/220	G.E.	
1	25	550	110/220	G.E.	
3	25	2200	110/220	West.	
3	20	2200	110/220	G.E.	
1	20	1100/2200	110/220	Pgh.	
10	15	2200	110/220	G.E.	
3	15	2300	220/440	Pgh.	
3	15	2300	220/440	Pgh.	
35	10	2200	110/220	G.E.	
40	10	2200	110/220	West.	
100	7½	2200	110/220	G.E.	
50	7½	2200	110/220	West.	
75	5	2200	110/220	G.E.	
50	5	2200	110/220	West.	

SERIES MOTORS—230 v.

1—175 HP G.E. type MD-109¼ 475 rpm.
5— 75 HP G.E. type 211 550 rpm.
1— 68 HP G.E. CO-2007, 475 rpm.
1— 50 HP Shaw.
1— 50 HP West. K-10 (500 v.) 435 rpm.
1— 30 HP G.E. CO-2002. 610 rpm.
1— 15 HP Crocker Wheeler 270 rpm.
6 2 HP Reliance, 850 rpm.

AIR COMPRESSORS

2—260 CFM Chic. Pneu. 12x10, 100# pres. 285 rpm., belt driven by 40 HP G.E. AC slipring Motors.

SQUIRREL CAGE MOTORS—3 ph. 60 cy.

Qu.	HP	Volts	Make	Type	Speed
25	½	220/440	Cr. Wh. with speed reducers		840
29	1½	220/440	Ilg.		490
25	2	220/440	Cr. Wh.		685
8	3	220/440	Cr. Wh.		850
6	5	220/440	G.E.	vert.	1150
30	5	220/440	Cr. Wh.		1140
25	7½	220/440	Cr. Wh.		675
2	15/30	220/440	West.	MS	550/1100
7	50	220/440	Wagner		850
3	60	220/440	Allis Chal. with speed reducers		1150 to 209 rpm
2	60	220/440	Cr. Wh.		670
2	75	220/440	G.E.	I-K	720
1	75	220/440	West.		1750
1	125	440	G.E.	I-K	720
1	125	220/550	G.E.	I-K	400
1	125	440	G.E.	I-K	450
1	125	440	G.E.	I-K	514
1	125	220/550	G.E.	I-K	850
1	150	220/440/550	G.E.	I-K	514
1	150	220/550	G.E.	I-K	450
1	150	550/220/440	G.E.		575
1	200	2200	West.	CS	870
1	200	220/440	West.	CS	580
1	200	2200/440/220	West.	CS	250
1	200	440	G.E.	I-K	720
1	200	220/550	G.E.	I-K	600
1	200	220/550	G.E.	I-K	514
1	225	2200/440/220	G.E.	TRE	200
1	250	220/550	G.E.	I-K	720
1	300	2200/440/220	West.	CS	400
1	350	2200/440/220	West.	CS	450
1	400	2200/440/220	West.	CS	600
1	450	2200/440/220	West.	CS	600
1	400	2200/440/220	West.	CS	500
1	500	2200/440/220	West.	CS	720

ELEVATOR

1—Westinghouse Elevator, traction type, 3000 lbs. Cap., platform 6x5, 2 gates on car, 4 sets of bi-parting doors, planed steel tees for main guides complete with AC motor and constant pressure control. All automatic.

INDUSTRIAL TRUCKS

3—Elwell Parker Tow Tractors 7' L. x 42" W. x 42" H. 4-16" wheels, ball bearing, 4 wheel steer, 4 wheel drive, 2000# DBP complete with Edison Batteries.
1—Baker Tow Truck 8'1x64"hx48" w.
100—small steel trucks with oak platforms 42"x24" heighth 17" with 4—12" roller bearing wheels and 5th wheel including handles.

SCALES

6—Fair. Morse #11½ 3 beams (2—200# ca. 1—50 lbs.) platform 16¼x21⅝.
9—Howe Scales 3 beams—platform 14½x22.

★ *FOR VICTORY TODAY AND SOUND BUSINESS TOMORROW—BUY WAR SAVINGS BONDS* ★

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MOTORS, GENERATORS, CONTROLS, TRANSFORMERS, MOTOR GENERATOR SETS, etc.

OVER 10,000 ITEMS IN STOCK FOR IMMEDIATE DELIVERY FROM EITHER ROCHESTER, N. Y. OR TOLEDO, OHIO REBUILT AND SOLD WITH A STANDARD NEW GUARANTEE.

THE FRED. W. KIEMLE CO.
33 N. SUPERIOR ST.
TOLEDO OHIO

TRANSFORMERS

4—500 KVA Gen. Elec. Type H form KDD, 60 cy. Single phase, Primary 6900V or 11950 Y; secondary 2300V—with primary taps—circular coil H design.

6—150 KVA Gen. Elec. type H 2200/220/440 25 cy. single phase.

1—200 KVA Allis Chal. 60 cy. 3 ph., 220/440.

1—300 KVA Gen. Elec. 60 cy. 3 ph., 220/440.

ALTERNATORS

200 KVA Gen. Elec. Ft. Wayne 3 ph., 60, 220/440, 720 RPM. revolving field.

150 KVA Gen. Elec. Type ATB form D, 60, 3 ph., 220/440 600 RPM., revolving field, built-in exciter.

D. C. GENERATORS

150 KW Western Elec. 3 big, 3 wire, 150/230 V, 600 RPM.

50 KW Milwaukee, Comp. Wound 125 V, 600 RPM.

FREQUENCY CHANGERS

All sizes, voltages and cycles.

★ 400 H.P. SYNCHRONOUS MOTOR ★

Complete A.C. Synchronous Motor

1—400 H.P. Wsghse Syn. motor, 3 ph, 60 cy 4000/2300 V, 400 RPM with built-in magnetic clutch. Complete panel mounted reduced voltage type Starting Control. Motor-Generator Set—factory built for excitation and clutch operation. 10 KW, 125 V, DC 1750 RPM, Type SK63, Wsghse, with direct conn. 15 HP, Type CS, 3 ph, 60 cy, 220/440 V.

3 ph. 60 cy. A. C. MOTORS

H.P.	Make		Type		Speed	Volts
300	Gen. Elec.	Sl. Rg.	I Form M		600	220/440
220	Gen. Elec.	Synch.	ATI dir. conn. Ex. 8 PF		600	220/440
200	Wsghse.	Sl. Rg.	CW		900	220/440
200	Gen. Elec.	Sq. Cg.	I Form K		514	220/440
175	Ideal	Sl. Rg.	AVA		1750	2200
150	Gen. Elec.	Sq. Cg.	I	K	600	2300
150	Burke	Sq. Cg.	3 big	2 ph	900	220/440
125	Gen. Elec.	Sq. Cg.	I	K	720	220/440

3 ph. 25 cy. MOTORS

H.P.	Make		Type	Speed	Volts
200	Wsghse.	Sl. Rg.	CW	485	220/440
200	Gen. Elec.	Sl. Rg.	I Form M	485	220/440
150	Gen. Elec.	Sl. Rg.	I Form M	500	2200
150	Gen. Elec.	Sl. Rg.	I Form M	750	2200
100	Wagner	Sl. Rg.	BR	750	220/440
100	Gen. Elec.	Sl. Rg.	I Form M	750	220/440
100	Wsghse.	Sq. C.	CS	500	220/440
75	Wsghse.	Sq. C.	CC6	500	220/440
75	Triumph	Aut. Start		750	220/440
75	Wagner	Sq. C.	BM	750	2200
75	Gen. Elec.	Var.	BTA	375/750	440

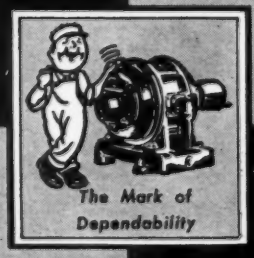
230 V DC MOTORS

H.P.	Make	Type	Speed
150	Burke	Comp. Inter.	450/700
105	Gen. Elec.	CL-6 Shunt Wound	700
100	Sprague	C Interpole	600
100	Northwestern	K30 Comp. Inter.	1750
100	Wsghse.	SK143 Shunt Inter.	1750
85	Gen. Elec.	Vert. Comp. Wound	700
40	Fair. Morse	Ball big. Vert. Comp.	1740
32	Sturdevant	C Form P. Shunt Wound	190

Only partial listing—Write or wire your inquiries

THE FRED. W. KIEMLE CO.
33 N. SUPERIOR ST.
TOLEDO OHIO

OVER 10,000 ITEMS IN STOCK FOR IMMEDIATE DELIVERY FROM EITHER ROCHESTER, N. Y. OR TOLEDO, OHIO REBUILT AND SOLD WITH A STANDARD NEW GUARANTEE.

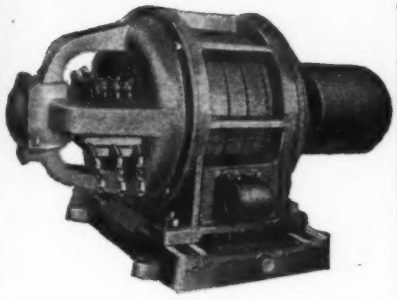


MOTORS, GENERATORS, CONTROLS, TRANSFORMERS, MOTOR GENERATOR SETS, etc.

BERGER BROTHERS ELECTRIC MOTORS INC.
395 STATE ST.
ROCHESTER NEW YORK

"ELECTRIC EQUIPMENT"—*Stock Shipment*

SLIP RING MOTORS



220/440 volt, 60 cycle

H.P.	Make	Type	RPM.
200	GE I-M	17A	514
200	West.	CW	585
200	West.		900
150	GE	I-15,M	875
150	Cr.Wh.		900
150	West.	CW	1800
100	GE	I-M	720
100	GE	MT 356	865
100	GE	I-M	900
100	West.	CW	1200
100	GE I-4	I-4	1750
75	Al-Ch.		490
75	GE	MT 356	720
75	Al-Ch.		900
75	GE	I-M	1800
60	GE	MT 566	600
60	GE	MT 346	900
60	GE	MT 536	1160
55	GE	I-M	490
50	GE	MT 352	690
50	GE	I-M	1200
50	Cr.Wh.	21Q	1150
50	GE	M T 536	1150
50	GE	MT 536	1165
40	West.	CW	690
40	GE	MT 346	690
40	GE	MT 342	900
40	GE	MTC 5522	1140
30	West.	CW	1160
30	West.	CW(2Ph.)	900
30	West.	CW (2ph.)	1160
25	GE	MT 326	850
25	GE	MT 326	1200
20	Cr. Wh.		1200
20	GE	MT 512	1145
20	West.	CW (2Ph.)	1160
15	GE	MT 322	845
15	GE	MT 312	845
15	West.	HF	870
15	GE	I-M	900
15	West.	CW	900
15	GE	MT 501	1800
10	GE	MT 510	840
10	GE	M-M	1120
10	West.	CW	1160
10	GE	MT 752	1720
7½	GE	MT 201	1080
7½	Al.Ch.	ARY	1200
7½	West.	CW	1750
5	West.	CW	1120
5	Al-Ch.		1130
5	GE	MT 936	1200
5	GE	MT	1700
5	West.	CW	1800

25 cycle—220/440 volt

H.P.	Make	Type	RPM.
500	West.	CW	435 2 brg.
300	West.	CW	435
125	Al.Ch.		750
125 KW	GE	ITT	1070, Fr. Chang.
125	GE	I-M	1500
100	GE	MT 357	1550
75	West.	CI	465
50	Al-Ch.		380
50	GE	I-M	705
50	West.	CW	750
40	West.	CW	750
37	GE	ITC 5015	475
25	GE	MT 337	705
7½	West.	CW	480
7½	Wagner	BR	500
7½	GE	ITC 5008	635
7½	GE	MT 512	700
5.5	GE	ITC	750

25 cycle, 2200 volt

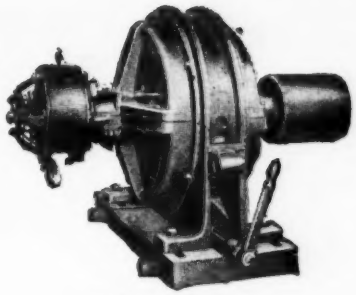
200	GE	I-M	500
100	GE	M	375
75	GE	I-M	500
75	GE	I-M	750

2200 volt—60 cy

H.P.	Make	Type	RPM.
400	GE*	I-P	257
300	GE	I-M	1200
206	GE	I-M 17A	600 2 brg
150	GE	I-16	600
150	West.	CW	720
150	GE	I-M	900
125	GE	MT 547	1800
100	West.	CW	1200
100	GE	M	720
86	GE	I-L	514
75	GE	I-L	720
75	GE	MT 356	720
75	GE	MT 356	900
60	GE	I-M	1800

550 volt—60 cy

600	GE	MT	220
250	West.	CW	720
200	GE	I-M	514
150	West.	CI	720
150	GE	I-M 15A	720 3 brg
150	Al-Ch.		720
150	GE	I-M	900
125	Al-Ch.		720
112	GE	ITC 5015	514
75	GE	MT 720	
60	West.	CW	1155
50	GE	MT 553	1200
40	GE	MTC 5522	1200
40	GE	MT 332	1200
25	Al-Ch.	ARY	720
25	Linc.		900
15	GE	MTC 5956	1150
10	West.	CW	1750
7½	GE	MT 952	1145



SPECIALS

TRANSFORMERS

3—200 KVA. General Electric H, KDD, 60 cy. 6600-2300 v. ser. 3 million
4—200 KVA. West. SK, 60 cy. 4000 v. 220-108 v. ser. 1 million

ALTERNATORS

75 KW. 2200/60/3/900 G. h
150 KW. 2200/60/3/900 G. E.
200 KW. 550/60/3/720 G. E.
300 KV. 2200/60/3/720 G. E.

GAS ENGINE GEN.

70 HP. Waukesha 1200 rpm. with either AC or DC generator
12 KW. Buffalo Marine Engine, 125 volt, 1750 rpm. DC Star
17 KW. Buda Engine Century 125 v. 1500 rpm. DC generator

PUMPS WITH MOTORS

250 HP. West. CS 2200/60/3/3600 Ingersoll, 1000 GPM. 780 ft. hd. 2 stage
2—125 HP. ditto, 300 GPM. 1100 ft. hd.
2—100 HP. ditto, 300 GPM. 800 ft. hd.

SQUIRREL CAGE MOTORS with comps.

75 HP. G. E. KT 352, 440/60/3/900 rpm.
6—100 HP. Al-Ch. AR 440/60/3/900
6—150 HP. Al-Ch. AR 440/60/3/900
2—200 HP. West. CS, 2200/60/3/1200

STEAM ENGINE Gen.

1000 KW. 250 v. West. SK, 90 rpm. with Penn Harris Cross compound engine

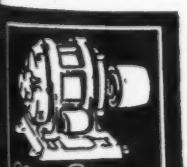
MOTOR GEN. SETS

1000 KW. 600 v. MPC, 1400 HP. 4400/60/3/ATI synchronous
150 KW. 250 v. Ridgeway, 225 HP. 2200/60/3/900 synchronous
100 KW. 250 v. Cr-Wh. 150 HP. 2200/60/3/1800 squirrel cage
50 KW. 125/250 v. West. SK, 1200 rpm. 75 HP. sq. or syn. drive
25 KW. 125 v. Ideal 40 HP. 440/60/3/1800 sq. cage drive

WLB RULING L-221

"(ii) The purchaser shall have attempted to obtain, from at least three dealers, a used motor or generator for the purpose for which the new motor or generator is sought to be purchased:"

Above is only partial list, many additional items are always being added. Send us your requirements.



OUR STOCK INCLUDES THE FOLLOWING

TRANSFORMERS	SAFETY SWITCHES	CAPACITORS
METERS	PANEL BOARDS	COMPENSATORS
MOTORS	ALTERNATORS	GAS ENGINES

We will buy for cash and resell to defense plants.

ELECTRIC EQUIPMENT CO.

678 LAKE AVE. **Phone Glenwood 6783** ROCHESTER, N. Y.

DEPENDABLE

Turbo-Generators

A PARTIAL LIST OF OUR INVENTORY

1—G.E. 3125-KVA, 3600-RPM, Condensing: 3/60/2300-v, 200#, 100° SH, 28" vacuum: Surface or Low Level Jet Condenser.

1—Westinghouse 2500-KVA, 3600-RPM, Condensing: 3/60/600-v, 200#, 100° SH, 28" Vacuum: Low Level Jet Condenser.

1—G.E., 1875-KVA, 3600-RPM, Condensing: 3/60/600-v, 200#, 100° SH, 28" Vacuum: Surface or Jet Condenser.

1—G.E., 1563-KVA, Non-condensing 3600-RPM, 3/60/600-v: 150#, 100° SH, 20# back pressure.

1—Allis-Chalmers 1250-KVA, 3600-RPM, 3/60/2300-v, 200#, 500° TT: Surface Condenser.

1—Westinghouse 1250-KVA, 250-v, direct current, condensing, 150/250-Lbs., Surface Condenser.

1—Allis-Chalmers 937-KVA, 3600-RPM, Condensing: 3/60/2300-v, 200#, 500° TT: Surface Condenser.

1—G.E., 625-KVA, 3600-RPM, Condensing: 3/60/2300-v, 200#, 500° TT, 28" vacuum.

1—G.E., 250-KVA, Non-condensing, 3600-RPM: 3/60/480-v, 150#, 0° SH, 28" Vacuum, 10# G. back pressure.

WILMS, WEAVER & CO. Penobscot Building DETROIT, MICH.

We Deal in Turbo-Generators Exclusively

CHICAGO ELECTRIC REBUILT POWER EQUIPMENT

—the immediate answer to your power problems!

FREQUENCY CHANGER

1400 HP 460 volts, 3 phase, 60 cycle, 300 RPM, 1500 amps. 1250 KVA power factor .9 50-deg. rise, type ATI-24, 1250-M-300 form C, with synchronous winding, field amps. 102, 1200 KW, 460 volts, 3 phase, 25 cycle, 300 RPM, 1570 amps. 1250 KVA power factor .8 50-deg. rise type ATI-10-1200-M-300 form C, synchronous winding, field amps. 121, with direct-connected exciter.

MOTOR-GENERATOR SETS

800 KW Elliott 250 v DC 440 v. syn.
300 KW Westg. 250 v DC 2200 v. syn.
235 KW Westg. 115 v DC 2200 v. syn.
225 KW Ideal 115 v DC 2200 v. syn.
150 KW Ideal 250 v. DC 440 v. syn.
100 KW G.E. 3-wire, 2200/440, ind.
100 KW Allis C. 3-W. 4000/2200 ind.
100 KW G.E. 250 v. 2200 v. ind.
100 KW Wtg. 125 v. DC 2200 v. ind.
100 KW Al. Ch. 125 v. DC 440 v. syn.
90 HP Wtg. 110 v. DC 75 KVA 2200 v.
75 KW G.E. (2) 125 v DC 3/25/220 AC.
75 KW G.E. 125 v DC 220 v. syn.
75 KW G.E. 250 v DC 440 v. ind.
75 KW G.E. 250 v DC 2200 v. syn.
70 KW G.E. 125 v DC 220 v. syn.
50 KW Al. Ch. 115 v DC 2200 v. ind.
50 KW Al. Ch. 125 v DC 2300/440 ind.
50 KW G.E. 125 v DC 4000/2200 ind.
33 KW G.E. 110 v DC 2200 v. syn.
22½ KW G.E. 125 v DC 220/440 ind.
15 KW Ideal 240 v DC 220 v. ind.
15 KW G.E. 220 v DC 220 v. ind.

SLIPRING

HP	Make	Type	Volts	Speed
2850	Wtg.	CW	6600	283
1500	Al. Ch.	ANY	2200	485
800	Wtg.	CW	6600	443
600	G.E. (2)	I-M	2200	1770
500	G.E. (2)	I-M	2200	600
350	G.E.	MT	2300	300
350	Al. Ch.		2200	300
300	G.E.	I-M	240	293
300	G.E.	I-M	2200	514
225	G.E.	I-M	220	600
200	Wtg.	CW	440	870
200	Howell	Rl. brg.	440	600
200	G.E.	I-P	440	1170
200	Wtg.	CW	440	345
200	G.E.	I-L	2200	585
200	Wtg.	CW	440	580
150	Wagner	BR	440	1140
150	G.E.	MT	440	875
150	Wtg.		440	600
150	Wtg.	CW	440	575
150	G.E.	I-M	220	600
150	G.E.	I-M	220	585
125	Wtg.	CW	2300	1750
100	G.E.	I-M	2300	600
100	West.	CW	440	575
100	G.E.	I-M	220	570
75	Northwestern	HW-50	220	1740
75	Allis Chal.	ARY	220	1160
75	Wtg.	CW	440	1160
75	G.E.	MT	440	1200
75	Allis Chal.	ARY	220	865
75	Cr. Wheeler	24Q	220	720
75	Allis Chal.		2200	690
75	Westg.	F	440	690

SYNCHRONOUS

HP	Make	Type	Volts	Speed
5000	G.E.		2300	82
2100	G.E.	ATI	4600/2300	514
800	Al. Ch.		2200	900
800	El. Machy.		6600	450
750	Westg. (2)		4000/2200	1200
650	Al. Chal.		2200	1200
270	G.E.	ATI	2300	600
200	Wtg.	HR	2200	225
190	Elec. Machy.		440	720

TRANSFORMERS

KVA	QU.	Make	Type	Pri.	Sec.
150	2	Wtg.	SK	2300/115	480/240
125	1	Kuhlman		2300	125
100	1	G.E. (25cy)	HT	9000Y	230
100	2	G.E.	H	4000/2300	110/220
75	3	Wtg.	S	3810	244/122
75	6	Wtg.	SK	3810	240/122
20	1	Moloney	HE	440	120/240
20	3	Moloney	HE	1150/2300	230/460
7½	1	G.E. 3 ph.	HT	6000Y	230
7½	1	G.E. 3 ph.	HT	2200	230/460
7½	1	G.E.	H	1100/2200	244/488
7½	1	Pitts.	HE	2200	244/488
7	1	Kuhlman air cld.		460	1/1.5/2

SQUIRREL CAGE

HP	Make	Type	Volts	Speed
200	GE.	KTP-557	2200	1800
250	Ideal	A	440	1150
200	G.E.	I-K	440	1200
200	Wtg.	CS	440	580
200	G.E.	I-K	440	580
150	Wtg. (2)	CCL	440	495
150	Al. Ch.		440	1170
100	G.E.	KT-356Y	440	900
75	Al. Ch.		440	865
75	G.E.	I-K	220	695
75	G.E.	I-K (5)	220	570
60	Wtg. bb	CS Vert. (4)	2200	1750
60	Wtg.	CS	220	435

WRITE, PHONE OR WIRE

CHICAGO ELECTRIC CO.,

1320 W. 22ND ST.
CHICAGO, ILL.

The HEAT is on — America needs more POWER

CHECK THIS LIST OF ITEMS READY FOR IMMEDIATE DELIVERY!

★ BOILERS

1—316 H.P. Heine Water Tube Boilers, 180 lbs. pressure, ASME code, complete with Jones 3 retort underfeed stokers, soot blowers, valves and piping, like new.

2—500 H.P. Heine Water Tube Boilers, 200 lb. pressure, complete with Combustion Engineering Type E underfeed stokers.

★ GENERATOR SETS

1—Ridgway, 750 KW Turbo Generator Set, 1800 RPM, mixed pressure turbine, 230 volt, DC Generator, complete with 3650 sq. ft. Wheeler Surface Condenser.

1—1000 KW General Electric Turbo Generator Set, 3 phase, 60 cycle, 2300 volt, 3600 RPM, turbine, 125 lbs. pressure with low level jet condenser.

SMALL AND MEDIUM SIZE MOTORS FOR SHIPMENT

220/440 VOLT AC—SQUIRREL CAGE

Quan.	HP	Make	Speed
1	50	GE	1800
1	50	Wag	600
1	40	Rel	900
1	30	Wag	720
2	30	Rel	1200
3	20	Rel	900
1	20	West	1200
1	20	U.S.	720
5	15	Rel	900
1	15	Wag	900
2	15	Cent	1200
3	5	GE	3600
1	5	West	1800
2	5	GE	1200
5	3	Imp	3600

220/440 VOLT—SLIP RING

Quan.	HP	Make	Speed
1	30	GE	900
2	150	Al. Ch.	720
	50	West	720

2300 VOLT—SQUIRREL CAGE

Quan.	HP	Make	Speed
3	100	GE	720
3	75	GE	900
4	75	GE	720
2	60	GE	900
2	50	GE	900
1	40	GE	1800
2	35	GE	900
2	10	GE	1800

SYNCHRONOUS

1—268 HP GE with belted Exciter—2300 V. 600 rpm
2—75 HP GE with direct conn. Exciters—220 V. 900 rpm

550 VOLT—SLIP RING

Quan.	HP	Make	Speed
1	25	GE	900
2	15	GE	900

MOTORS

230 Volt DC

Quan.	HP	Make	Type	Speed
1	100	Rel	T	500
3	50	West	SK	565
1	40	AC		950/1150
1	35	GE	LC	650
1	30	AC		575
1	25	West	S	650
1	20	West	SK	850
1	20	Rel	T	825
7	15	GE	RC	850
2	15	West	SK	850
1	15	West	SK	1150
6	15	Rel	T	850

Quantity of small sizes from ½ to 10 H.P. in addition to those listed.

★ MOTOR GEN. SET

300 KW Gen. Elec. Syn. Motor Generator set. Motor: 435 H.P., 3 ph., 60 cy., 4000 V., 1200 RPM, Type ATI. Gen; 300 KW type MPC 250 V, 1200 RPM.

★ STEAM ENGINES

100 KW Skinner Unaflow 150#, 250 RPM direct connected to 115 Volt West. Generator cpd. Interpole

80 HP Chandler & Taylor 13x16—200 RPM 100# pressure

★ TUBES

9,000 Condenser Tubes 1" OD 20 Gauge Admiralty 18 ft., long like new

HEAT & POWER COMPANY Inc.

5 BOND ST. Algonquin 4-3874 NEW YORK CITY, N. Y.

THE PICK OF POWER EQUIPMENT

TURBO UNITS—60 Cy.

1—12000 KW General Electric Cond.
1— 6250 KVA General Electric Cond.
1— 4000 KW General Electric Cond.
1— 4000 KVA Allis Chalmers Cond.
1— 3125 KVA General Electric Cond.
1— 2850 KVA Westinghouse Cond.
1— 1250 KVA General Electric Cond.
1— 937 KVA General Electric Cond.
1— 750 KVA General Electric Cond.
1— 375 KVA General Electric Cond.
1— 250 KVA General Electric Cond.
1— 938 KVA West. 375# I.P. 100# B.P. N-C
1— 937 KVA Moore-Allis N-C. Bleeder
1— 312 KVA Moore Non-Condensing
1— 250 KVA Westinghouse Non-C.
1— 125 KVA Moore Non-Condensing
1— 125 KVA Westinghouse Non-C.
1— 83.5 KVA Westinghouse Non-C.

STEAM ENGINE UNITS—60 Cy.

1—1067 KVA Nordberg Uniflow
2— 937 KVA Nordberg Uniflow
1— 500 KVA Rice & Sargent Corliss
1— 325 KVA Skinner Uniflow
1— 300 KVA Hamilton 4-valve
1— 250 KVA Harrisburg Uniflow
1— 150 KVA Hamilton Poppet Valve

DC STEAM ENGINE UNITS

1—500 KW Skinner Uniflow 250 V.
1—350 KW Ridgway 4-valve 250 V.
1—300 KW Skinner Uniflow 250 V.
1—300 KW Erie City 4-valve 250 V.
1—200 KW Chuse 4-valve 250 V.
1—150 KW Erie Ball 4-valve 250 V.
1—150 KW Ames Uniflow 125 V.
1—100 KW Ames Uniflow 120 V.
1—100 KW Elliott 4 valve 250 V. 3-wire
1— 75 KW Skinner Uniflow 250 V.
1— 50 KW Ames Uniflow 125/250 V. 3-wire

OIL & GAS ENGINE UNITS—60 Cy.

1—1000 KVA Cooper (gas) 240 V.
1— 720 KW McInt.-Seymour 2300 V.
1— 400 KW West. (gas) 440 V.
1— 312 KVA Anderson 2400 V.
1— 49.5 KVA Fairbanks Morse 120 V.
1— 32 KVA Fairbanks Morse 120 V.

WATER TUBE BOILERS

4—1000 HP Heine 250-lb. Oil Fired
1—1000 HP Edge Moor 200-lb. Stokers
1— 800 HP Connelly 250-lb. Stoker
4— 750 HP Edge Moor 200-lb.
2— 633 HP Bigelow Hornsby 225-lb.
6— 600 HP Stirling 180-lb. Stokers
2— 520 HP Heine 200-lb. Hand Fired
1— 512 HP Stirling 200-lb. Stoker
2— 490 HP Stirling 200-lb.
8— 400 HP Stirling 200-lb.
1— 400 HP B. & W. 160-lb. Stoker
2— 350 HP Stirling 200-lb.
2— 336 HP B. & W. 200-lb. McClave-Brooks Stoker
2— 302 HP B. & W. 200-lb. Hand Fired
2— 282 HP Edge Moor 200-lb. Stokers

STOKERS

4— 14-Retort Westinghouse
2— 6-Retort Taylor
2— 5-Retort Westinghouse
2— 4-Retort Westinghouse
5—200 HP Huber

SYNCHRONOUS MOTORS—60 Cy.

2—800 HP Electric Machy. 6600 V. 450 RPM
1—400 HP Allis Chalmers 2300 V. 600 RPM
1—290 HP Allis Chalmers 2300 V. 600 RPM
1—200 HP General Electric 2200 V. 1800 RPM
1—175 HP General Electric 230 V. 225 RPM
1—175 HP General Electric 220 V. 200 RPM
1—150 HP General Electric 440 V. 164 RPM
1—100 HP General Electric 2300 V. 240 RPM

MOTOR GENERATOR SETS—60 Cy.

1—1500 KW General Electric 600 V. DC
1—1000 KW General Electric 600 V. DC
1— 500 KW General Electric 600 V. DC
1— 300 KW General Electric 275 V. DC
2— 200 KW Westinghouse 125 V. DC
1— 100 KW General Electric 125 V. DC
1— 75 KW General Electric 125 V. DC

ROTARY CONVERTERS—60 Cy.

1—1000 KW Westinghouse, 600 V.
1— 750 KW Westinghouse, 600 V.
1— 500 KW General Electric, 250 V.
1— 500 KW General Electric, 600 V.
2— 300 KW General Electric, 600 V.

OIL CIRCUIT BREAKERS

1— 800 A. 87 KV Am.Br.Bov. AF22 Outdoor
2— 600 A. 73 KV West. G222AS Outdoor
1— 400 A. 73 KV G. E. FKO 36 Outdoor
2— 600 A. 37 KV Condit FO40A Outdoor
4— 400 A. 34.5 KV Condit F-16-A Outdoor
2—1000 A. 30 KV Kelman CB-76 Outdoor
4— 600 A. KV West. CO-2 Outdoor
2— 600 A. 15 KV Kelman CB-76 Outdoor
4— 600 A. 15 KV G. E. FKO-60-B Outdoor

INDUCTION MOTORS—60 Cy.

4—3500 HP G. E. slip ring 2300 V. 120 RPM
2— 800 HP G. E. slip ring 2300 V. 300 RPM
2— 400 HP G. E. slip ring 3800 V. 1800 RPM
2— 300 HP G. E. sq. cage 440 V. 600 RPM
2— 250 HP G. E. sq. cage 4000 V. 1200 RPM
1— 250 HP G. E. slip ring 2200 V. 450 RPM

FREQUENCY CHANGERS

2—3125 KVA West. 25/62½ cy. 750 RPM
1—3000 KVA G. E. 60/25 cy. 300 RPM
1—2500 KVA West. 25/60 cy. 300 RPM
1—1500 KW G. E. 25/60 cy. 300 RPM
1—1000 KVA G. E. 60/25 cy. 514 RPM
1— 750 KVA G. E. 25/60 cy. 300 RPM

SYNCHRONOUS CONDENSERS

1—4000 KVA G. E. 13200 V. 514 RPM
1—2000 KVA G. E. 11000/2200 V. 720 RPM
1—2000 KVA C. W. 11000 V. 600 RPM
1—1000 KVA G. E. 2300 V. 900 RPM
1— 500 KVA West. 2200 V. 900 RPM

TRANSFORMERS—1 Ph. 60 Cy.

3— 600 KVA West., 120,000/2300 V.
1— 5000 KVA Allis, 72000/6600 V. 3 ph.
3— 500 KVA Allis, 33000/480 V.
6— 250 KVA Penn, 34500-17250/4600-2300 V.
1—10000 KVA G. E., 26400 Y/2300 V. 3 ph.
3— 1500 KVA Pitts., 22000/6600 V.
2— 1000 KVA G. E., 23000-11500/575 V.
4— 667 KVA West., 22000-11000/2300 V.
3— 250 KVA G. E., 22000/11000 V.
[illegible] 00 KVA Pitts., 13200/4600 V. 3 ph.
2— 5000 KVA American, 13800/2300 V.
1— 450 KVA G. E., 13200/240-480 V. 3 ph.
3— 150 KVA Pitts., 13800/230-460 V.
3— 150 KVA Pitts., 11000/2400 V.
3— 100 KVA West., 11000/250-125 V.
3—1250 KVA G. E., 6600/550 V.
3—1000 KVA Pitts., 2300-4600/550 V.
3— 667 KVA G. E., 2300-4000Y/500-480-460 V.
6— 100 KVA Pitts., 2300/575 V.

PARTIAL LIST—WE HAVE ALL CLASSES OF POWER EQUIPMENT

BREW, WOLTMAN & Co., INC.

50 CHURCH STREET, NEW YORK CITY

POWER PLANT EQUIPMENT CO., INC.

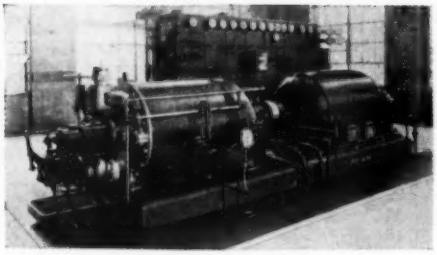
39 Cortlandt Street
New York, N. Y.

A C TURBINE UNITS

6250 KVA. G.E. 2300 V. Cond.
2500 KVA G.E. 2300 V. Cond.
1875 KVA Al. Chal. 2300 V. Cond.
1500 KVA Al. Chal. 480 V., low press.
1250 KVA G.E. 2300 V. Cond.
1000 KVA Wghse. 2 ph., 600 V. Cond.
937 KVA Al. Chal.-Moore 480 V., Non-Cond. and bleeder
937 KVA Al. Chal. 2300 V. Cond.
937 KVA Al. Chal.-Elliot Mixed Pres.
780 KVA Al. Chal. 2300 V. Cond.
780 KVA Al. Chal.-Terry 600 V.; Auto bleeder
625 KVA Wghse. 2300 V. Cond.
625 KVA G.E. 2300 V. Cond.
625 KVA Al. Chal.-Elliot 240/480 V. Auto bleeder
375 KVA G.E. 2300 V. bleeder
375 KVA G.E. 2300 V. Non-Cond.
312 KVA Ridway-Elliot 480 V. Cond.
150 KVA Wghse. 240 V. Cond.

STEAM ENGINE SETS

1000 KW Al. Chal. 240 V.; with Al. Chal. cross comp. Condensing Engine
312 KVA G.E. 2300 V. A.C.; with Chuse Uniflow Engine
200 KW G.E. 125 V. with Erie Ball 4 V. Engine
200 KW G.E. 125 V. with Skinner Uniflow Engine
150 KW G.E. 240 V. with Erie Ball 4 V. Engine
125 KW G.E. 240 V. with Erie Ball 4 V. Engine
100 KW G.E. 240 V. with Erie Ball 4 V. Engine
100 KW G.E. 125 V. with Erie Ball 4 V. Engine
20 x 21 Skinner Uniflow, belted, 175 lbs. (15 to 25 lbs. b.p.)



● BLEEDER TURBINE UNIT

625 KVA Allis Chalmers-Elliott 3 ph. 60 cy. 240/480 v.; automatic bleeder; with jet or surface condenser

TRANSFORMERS

687 KVA (2) Maloney 13800—460 V.
500 KVA (3) Al. Chal. 33000—440 V.
250 KVA (3) Packard 22000—2300 V.
250 KVA (2) G.E. 6600-2300 V.
150 KVA (2) G.E. 2300/4000-115/230 V.
100 KVA (3) Al. Chal. 22000—440 V.
100 KVA (6) G.E. 13200—2300 V.

FIRE PUMPS (Motor Driven)

1600 GPM Al. Chal. 216' head; dir. con.
1500 GPM Worthington 216' head; dir. con.
850 GPM Al. Chal. 243' head; dir. con.
8" Hill 2 stage; dir. con.

STOKER

Illinois Chain Grate for 1300 HP

COAL PULVERIZERS

8000 lbs. Fuller Bonnett; Motor Driven
6000 lbs. Whiting; Motor driven
2—4500 lbs. Erie City; Motor Driven

ROTARY CONVERTER

1250 KW G.E. 240 V.; with 2300 V. Transformer

COMPRESSORS

250 CFM Pennsylvania 150 lbs.; dir. con. 60 HP Syn. Motor
2—165 CFM Chicago pneu. 50-70 lbs., with motors
2—103 CFM Chicago pneu. 75 lbs.; with motors

BOILERS (ASME)

749 HP (4) Edgemoor 200 lbs.
500 HP Murray (Heine) 180 lbs.
298 HP (3) Sterling 200 lbs.
253 HP (2) Heine 160 lbs.

SURFACE CONDENSERS

3850 Sq. Ft. Worthington
2400 Sq. Ft. Al. Chal.
800 Sq. Ft. Wheeler
625 Sq. Ft. Wheeler

DIESEL ENGINE SETS

900 KVA G.E. 3 ph.—McIntosh-Sey.
375 KVA Wghse. 3 ph.—Busch-Sulzer
312 KVA Burke 3 ph.—Anderson
219 KVA G.E. 3 ph.—Worthington
200 KVA G.E. 3 ph.—Buch-Sulzer
50 HP Fairbanks "VA" belted

MOTORS • GENERATORS • TRANSFORMERS

Prices on Application

3 PHASE, 60 CYCLE, 220/440 V.

HP	Make	RPM	Type	Frame
⅓	West.	1200	CCL	2 phase
½	American	600	totally enc.	ball bearing
¾	Gen. Elect.	1800	KT	944
1½	Gen. Elect.	1800	KQ	944 2 phase
10	Fairbanks Morse	900	KBY	
10	Crocker Wheeler	900	Nema	365
10	Burke	1800		
15	Reliance	1200		2 phase
15	Howell	900		2 phase
20	Gen. Elect.	1800	KQ501	2 phase
20	Gen. Elect.	565	I	Form K
25	Gen. Elect.	1740	KQ312	2 phase
25	Armor	1200	ball bearing	2 phase
25	Gen. Elect.	1800	KT	312
30	Gen. Elect.	3600	KT	513
30	Armor	695	ball bearing	2 phase
50	West.	1200	MS	
50	Fairbanks Morse	1800	ball bearing	
50	Fairbanks Morse	1800	ball bearing	
50	West.	1800	CS	
60	Gen. Elect.	1800	I	form K
75	Gen. Elect.	1800	I	form K
75	Gen. Elect.	900	KT	552
100	Gen. Elect.	1800	I	form K
100	West.	1800	CS	
150	Gen. Elect.	1200	I	form K
150	Gen. Elect.	1200	I	form K

MOTOR GENERATOR SETS

1—100 KW Ridgeway sets 250 v. DC. 1200 RPM direct connected to 150 HP. Ridgeway synchronous motors, 3/2200/60/1200 complete with panels.

1—100 KW. Crocker Wheeler 250 v. DC 500 RPM direct connected to 150 HP General Electric Motor 3 PH 25 cycle 2200 volts 500 RPM, complete.

1—75 KW Ridgeway 140 v. DC 1200 RPM direct connected to 120 HP Ridgeway synchronous motor 3/2200/60/1200 RPM. Complete.

1—35 KW Westinghouse Generator 125 volt DC 1450 RPM direct connected to 53 HP West. CS motor 3 ph. 25 cy. 220 v. 1450 RPM. Complete.

25 Rotary Converter

1—150 Allis Chalmers Rotary 250 Volts D.C. 500 R.P.M. complete with panels. Transformer 25 cycle, 2300 volts.

SLIPRING MOTORS

60 CYCLE, 3 PHASE, 220/440 VOLTS

HP	Make	Speed	Type	Frame
10	Gen. Elect.	1800	MT	303
15	Gen. Elect.	1800	I	form M
20	Gen. Elect.	545	MT	332
20	Westinghouse	575	CW	648A
20	Westinghouse	575	CW	ball bearing
25	Westinghouse	690	CW	
30	Gen. Elect.	1800	MT	327
30	Gen. Elect.	1800	I	form M
40	Westinghouse	690	CW	748
40	Westinghouse	690	CW	748A
40	Westinghouse	690	CW	748A
40	Westinghouse	690	CW	748A
50	Westinghouse	900	CW	
60	Westinghouse	720	CW	2200 volt
75	Westinghouse	1800	CW	
300	Gen. Elect.	1200	I	form M
500	Westinghouse	600	CW	

TRANSFORMERS

Amt.	Kva.	Make	Cycle	Voltage
21	25	G.E.	25	2300/230/460
6	40	G.E.	5	2300/230/460
6	30	G.E.	25	2300/115/230
24	50	G.E.	25	2300/230/460
3	50	Packard	25	6900/230/460
18	50	G.E.	60	4160/4600/230/460
3	75	60	60	4160/4600/230/460
18	100	G.E.	60	4160/4600/230/460
3	100	Kuhlman	25	2300/230/460
3	200	G.E.	60	2300/230/460
3	200	G.E.	60	6900/230/460
3	200	Kuhlman	60	4160/4600/230/460
3	500	Pitts.	25	11500/220
3	1000	Pitts.	60	2300/4600/230/460

Prices on Application

3 PHASE, 25 CYCLE, 220/440 VOLTS

HP	Make	RPM	Type	Frame
50	Gen. Elect.	750	I	form K
50	Westinghouse	750	CS	
75	Gen. Elect.	750	KT	357
75	Gen. Elect.	750	I	form K
100	Gen. Elect.	750	I	form K
100	Gen. Elect.	300	117	form K
150	Gen. Elect.	750	I	form K
150	Gen. Elect.	750	I	form K
200	Westinghouse	460	CS	2200 volt
200	Gen. Elect.	750	I	form K
225	Elec. Machinery	500	2200 volt	synhronous
1150	Gen. Elect.	375	2300 volt	synchronous
200	Westinghouse	235	CW	slipring

SPECIAL MOTORS

1100 H.P. General Electric Synchronous Motor, 3 ph., 25 cy., 11,500/6600/2200 V., 375 RPM.

500 H.P. Allis-Chalmers, 3 ph., 25 cy., 440 V., 490 R.P.M., Complete.

300 H.P. G.E. Slipring, 25 cy., 3 ph., 2200 V., 500 RPM, 3 bearing; complete with controls.

225 H.P. Electric Mchy Co. Synchronous, 3 ph., 25 cy., 2200 V., 500 R.P.M. with controls.

1—100 H.P. G.E. Synch. Motors, 3 ph., 25 cy., 220/440 V., with control equipment.

1—20 HP. Gen. Elec. Motor 230 v. DC. Type CD83 1750 RPM.

1—75 HP. Westinghouse Motor Type SK, 230 v. DC 475/950 RPM variable speed.

FREQUENCY CHANGERS

2—1250 KVA Gen. Elec. Synchronous—motor 3/25/2200 750 RPM, direct connected to Generator 3/62½/440 V. Complete with exciters and panels.

1—200 KW General Electric 3 ph., 60 cy., 2300 V. direct connected to 290 HP. Gen. Elec. Synchronous Motor, 3 ph., 25 cy., 440 volt, 750 RPM. Complete with panels.

1—120 KVA Gen. Elec. Induction Frequency Changer, 440 V., 3 Phase, 62½ Cycle. Driving motor 100 H.P., 3/25/440 RPM. Complete.

94 KVA Westinghouse Synchronous Set Generator, 62½ cy., 230 v., 750 RPM with panels. Motor 112 HP. 3/25/2300/750 Synchronous with starting equipment.

ERIE ELECTRIC CO., INC.

124 CHURCH ST. BUFFALO, N. Y. CL. 4758

1893 ★ AMERICA'S PIONEER REBUILDER ★ 1943

Celebrating Our 50th Anniversary

MOTORS

D. C.

Qn.	H.P.	Make	Type		Volts	RPM
1	100	Whse.	Crane	#5542	230	750
1	125	Whse.			230	1100
1	60	Roth	128RS		230	1750

A. C. SQUIRREL CAGE

1	200	Whse.	CS	3/60/220/440	720
1	200	G.E.	IK	3/60/220/440	600
1	125	Al.-Ch.	ARW	3/60/220/440	3500
1	75	Wag.	31V		
			84RN	3/60/220/440	514

A. C. SLIP RING

1	650	Whse.	CW	3/21/440	365
1	200	G.E.	IM	3/60/220/440	600
1	175	Lincoln Fr.	IXV	3/60/220/440	600
1	150	G.E.	3-brg. IM	3/60/220/440	450
1	150	G.E.	3-brg. IM	3/60/220/440	600
1	125	G.E.	IM	3/60/220/440	600

A. C. SYNCHRONOUS

1—225 H.P. G.E., type ATB 3/60/220/440 V., 600 R.P.M.

1—220 H.P. G.E., type ATI, .8 p.f., 3/60/240/480 V., 720 R.P.M.

1—50 H.P. Elec. Machy., .8 p.f., 3/60/440/2400 V., 400 R.P.M.

SWITCHBOARDS

A.C. AND D.C. BUILT TO SPECIFICATIONS. A LARGE STOCK OF A.C. AND D.C. SWITCHBOARD INSTRUMENTS AND CURRENT TRANSFORMERS.

A. C. SINGLE PHASE—60 CYCLE

1	10	Century	RS	110/220	900
1	15	Wagner	BA	110/220	900
1	25	Century	RS	110/220	1200

GENERATORS

D. C.

Qn.	K.W.	Make	Type	Wind.	Volts	RPM
1	65	Cr.-Wh.	H	Comp.	500	1750
1	65	Cr.-Wh.	H	Comp.	250	1750

A. C.

1—225 KVA G.E. type ATB 3/60/220/440 V., 600 R.P.M.

1—187½ K.W. Gen. Elec., 8. p.f. type ATI, dir. conn. exciter, 3/60/240/480 V. 720 R.P.M.

1—150 KVA GE., type ATB, 3/60/240/480/2300 V., 600 R.P.M.

1—150 KVA Allis Chalmers, 3/60/2300 V. 900 R.P.M. with belted exciter.

1—50 KVA General Electric, ATB, 3/60/220/440 V, 1200 RPM Built in Exciter.

1—40 KVA Fairbanks Morse, 3/60/220/440/2300 V, 1200 RPM.

1—37½ KW Elec. Mchy., .8 p.f. 3/60/240/480/2400 V, 400 R.P.M. with belted exciter.

2—30 KW Gen. Elec., type ATB, p.f. .75, 3/60/220 V., 720 R.P.M. with dir. conn. exciter

MANY MORE ITEMS

These listings are only a small fraction of our stock. Let us know your requirements. All inquiries will receive prompt and courteous replies.

PHONE • WIRE • WRITE

PLATING GENERATOR

1000 Ampere Hobart, 6-12 volts, Ball Bearing, 3/60/220/440 V, 1750 R.P.M.

M. G. SETS

1—3 K.W. Hertner, 110 V. D.C. vertical dir. conn. to 7 H.P. 3/60/220/440 V. 1800 R.P.M

1—40 K.W. Gen. Elec., type CL, 125 V. D.C. dir. conn. to 60 H.P. Gen. Elec. 3/60/440/2300/4000 V. 900 R.P.M.

1—75 KW Gen. Elec., type DLC, 125V dir. conn. to 115 H.P. Ge.n Elec., type K 3/60/2300/4000V.

1—100 KW General Electric, Type TCC, 3 Phase, 275 Volts D.C. 1200 RPM Rotary Converter complete with Transformers, Switchboards and Accessories.

1—150 K.W. Wstghse. Rotary Converter, 250 V. D.C. complete with transformer, starting equipment and D.C. panel.

1—200 K.W. Wstghse. Rotary Converter, 250 V. D.C. complete with transformer, starting equipment and D.C. panel.

1—300 K.W. Allis Chalmers, 600 V. D.C. dir. conn. to Allis Chalmers synchr. 2 bearing unit, 3/60/2300 V. 600 R.P.M.

METERS

WATT HOUR METERS, SINGLE PHASE, POLY-PHASE, D.C., ALL MAKES AND CAPACITIES.

SWITCHES

SAFETY SWITCHES. LARGE ASSORTMENT. ALL SIZES, 2 AND 3 POLE, ATTRACTIVE PRICES.

OIL SWITCHES

AND CIRCUIT BREAKERS. ASSORTED CAPACITIES AND MAKES AT VERY LOW PRICES.

GREGORY ESTABLISHED 1893 Hi-Grade Rebuilt

GREGORY ELECTRIC CO.

GREGORY ESTABLISHED 1893 Hi-Grade Rebuilt

2634 S. WABASH AVENUE, CHICAGO, ILLINOIS

NOTEWORTHY EQUIPMENT

SQUIRREL CAGE
220/40 VOLTS

1— HP GE IE 15K	1200
1—200 HP WEM CS	1200
1—100 HP GE KT	900
1—100 HP Allis	900
3—150 HP GE IK	1200
1—150 HP WEM CS	1200
1— 75 HP WEM CS	580
1— 75 HP GE IK	690
1— 75 HP GE IK	600
1— 50/100 HP WEM CS	345/700
1— 50 HP GE IK, 3 bearing	490
3— 50 HP GE IK	1200
2— 75 HP GE IK	1200
1— 75 HP WSM CS	1200
1— 40 HP GE KT	1200
1— 40 HP GE KT	690
1— 40 HP WEM CS	1160

SQIRREL CAGE
2300 VOLTS

1—200 HP GE I-K	1800
1— 75 HP Allis	1800
1—150 HP GE I-K	720
2— 50 HP GE KT	600
1— 40 HP GE KT	1200
1— 40 HP Electro Dyn.	1800
1— 30 HP F. B. Morse	1200
1— 75 HP GE KT	600
1— 60 HP GE IQ 2 ph.	690
2—300 HP GE IE	1800

NEW 230 VOLTS SK

1—30 HP SK 93	1750 CP
1—20 HP SK 100-L	900 CP
2—25 HP SK 100-L	1150 CP
1—20 HP SK 93	1150 CP
1—10 HP SK 60-L	1150 CP

CENTRIFUGAL PUMPS

1—Goyne Pump Co. 12" volute acid resisting bronze 1200 RPM, 6000 GPM, 205 ft., head on base, ready to receive driver.

1—Scranton, 6" two stage acid resisting bronze 1200 GPM, 160 ft. head, 1200 RPM. on base, ready to receive driver.

1—Barrett-Haentjens C.I. bronze fitted, 850 GPM, 210 ft. head, 1750 RPM, with 40 H.P. Westinghouse CS, 440 V, 60 cycle, 3 phase, squirrel cage motor.

1—Worthington, 4" C.I. bronze fitted, 600 GPM. 186 ft. head, with 50 H.P. G.E. KT., 440 volts, 60 cycle, 3 phase, 1750 RPM.

MOTORS • TRANSFORMERS • GENERATOR SETS • ROTARY CONVERTERS
ALTERNATORS • PUMPS • HOISTS • COMPRESSORS

Approximately 4000 other AC-DC — Motor Generator Sets — Transformers—Pumps—Fans—Compressors—Hoists, etc.

PENN ELECTRICAL ENGINEERING COMPANY

517 ASH STREET, SCRANTON, PA.

SYNCHRONOUS CONVERTERS

500 KW WEST. 250 D.C. 2300/4000 A.C. 1200 RPM
300 KW G.E. 600 D.C. 2300/4000 A.C. 1200 RPM
300 KW G.E. 250 D.C. 2300/4000 A.C. 1200 RPM.
200 KW AL-CH. 250 D.C. 2300/4000 A.C. 1200 RPM
150 KW G.E. 250 D.C. 2300/4000 A.C. 1200 RPM
150 KW WEST. 250 D.C. 2300/4000 A.C. 1200 RPM

MOTOR GENERATORS

300 KW G.E. SYN. 250 V. 2300/4000 A.C. 1200 RPM
300 KW G.E. SYN. 250 V. 2300/4000 A.C. 720 RPM
250 KW G.E. SYN. 250 V. 2300/4000 A.C. 720 RPM
200 KW G.E. IND. 600 V. 2300 A.C. 1200 RPM
200 KW R.W. SYN. 250 V. 2300/4000 A.C. 900 RPM

TURBO GENERATOR SET

300 KW GENERAL ELECTRIC-CURTIS, 250 V. D.C. Turbine, Non-Condensing, 100# Steam Pressure, 3600 RPM. GEN. ELEC. 300 KW, MPC Generator and D.C. Panel.

Each unit listed above is owned by us and is Available now for immediate purchase.

WALLACE E. KIRK CO.

Incorporated

502 Grant Building Pittsburgh, Pa.

Motor Generator Sets—Synchronous Motors, etc.

MOTOR GENERATOR SETS & ROTARIES
3 phase, 60 cycle, A.C.

2—West. 250 KW 250 Volt rotaries
1—West. 100 KW 250 Volt rotaries

VERTICAL MOTORS

1—G. E. 50 HP 1200 RPM 3 phase 60 cycle 220 Volt
1—Reliance Fan-cooled new 25 HP 1750 RPM 220/440 Volt

SYNCHRONOUS MOTORS
3 phase, 60 cycle

2—G. E. 700 HP 720 RPM 6600/4000/2300 Volt
1—Burke 300 HP 900 RPM 440/220 Volt
1—Ideal 50 HP 600 RPM 2300 Volt

SLIP RING MOTORS 3 phase, 60 cycle

Allis-Chalmers 250 HP 600 RPM 440 Volt
G. E. 60 HP 600 RPM 440 Volt
G. E. 62½ HP 1150 RPM 440/220 Volt

ADJUSTABLE SPEED D.C. 230 Volt

1—West Sk-180 100 HP 600/950 RPM
2—Electro Dynamic 60 HP 450/1200 RPM
1—Electro Dynamic 60 HP 525/1100 RPM
1—Reliance 1400-T 50 HP 175/700 RPM
1—G. E. 25 HP 400/1600 RPM
3—G. E. 25 HP 500/1500 RPM
3—G. E. 15 HP 450/1800 RPM
1—G. E. 15 HP 550/1100 RPM
1—G. E. 10 HP 250/1000 RPM
1—West. 10 HP 400/1600 RPM

ALTERNATOR SPECIAL, Allis-Chalmers, 125 KVA, 277 RPM, 3 phase, 60 cycle

The Electric Motor & Repair Co., Cuyahoga Falls, O.

DIESEL ENGINES AND GENERATOR SETS
IN OUR STOCK

1—20 HP Fairbanks-Morse	1—80 HP Atlas Imperial*	1—150 HP Hercules*
2—50 HP Int. Harvester UD-9	2—100 HP Fairbanks-Morse	1—180 HP Fairbanks-Morse
1—50 HP Cummins*	1—112½ HP Buckeye	1—360 HP Fairbanks-Morse
1—68 HP Buda*	2—120 HP Atlas*	1—440 HP Ingersoll-Rand

*Fitted With Clutch and Power Take-Off

A. G. SCHOONMAKER COMPANY

50 CHURCH STREET PHONE—WORTH 2-0455-6-7 NEW YORK, N. Y.

300 KW ROTARY CONVERTER

1—300 KW Westinghouse Rotary Converter, 600 volts, D.C., 6 phase, 60 cycles, pedestal bearings, 1200 RPM.

SYNCHRONOUS MOTOR

1—250 HP Westinghouse Type HR, for 3/60/2200 volts, 277 RPM, Engine Type.

DEEP WELL PUMPS

2—600 GPM, 116 ft. Kingsford Centrifugal Pumps driven by 40 HP General Electric Type CD, 230 V. DC motors

HOIST

1—50 HP Lidgerwood Double Drum Hoist, 24x24" drums side by side with or without motor. AC or DC.

ELECTRIC EQUIPMENT
FOR
INDUSTRY

LET US KNOW YOUR REQUIREMENTS

REBUILT & GUARANTEED STOCK
MOTORS, D.C. & A.C.
TRANSFORMERS
MOTOR GENERATOR SETS
ROTARY CONVERTERS
SWITCHBOARDS BUILT TO ORDER

100 KW ROTARY CONVERTER

1—100 KW General Electric Rotary Converter, Type TCC, 250 volts D.C., 3 phase, 60 cycles, 2300 volts A.C.

SYNCHRONOUS MOTOR

1—250 HP Westinghouse Type HR, for 3/60/2200 volts, 240 RPM Engine Type.

CRUSHERS

2—36x48" Link Belt Double Roll Crushers for 1½" to 3" size

DYNAMOMETER

1—Taylor "Hi-Eff" Dynamometer for miscellaneous engine and other types of testing.

FREQUENCY CHANGERS — TURBO GENERATORS — AC & DC MANUAL MAGNETIC CONTROL — CENTRIFUGAL PUMPS — AC & DC SWITCHBOARDS

FOR DETAILS, WRITE **JOHN D. CRAWBUCK CO.** 714-15 EMPIRE BLDG. PITTSBURGH, PENNA.

Let MacCABE lift your Worries!

OVERHEAD ELECTRIC TRAVELING CRANES

Tons	Make	Span	Current
(2)-1	Maris	35′ 7″	230-VDC. FL. OP.
(2)-1½	Euclid	30′ 0″	115/230-VDC. FL. OP.
(1)-2	P & H	34 8″	230-VDC. CG. OP.
(2)-3	Sprague	20′ 6″	115/230-VDC. FL. OP.
(2)-3	Armington	12′ 4″	230-VDC. CG. OP.
(Sprague & Armington Cranes Underslung Type with Overhang)			
(1)-5	Shep. Niles	30′ 0″	230-VDC.
(1)-5	Cleveland	34′ 3″	230-VDC.
(1)-10	Whiting	32′ 0″	220-V-3-PH-60-CY.
(1)-20	P & H	50′ 0″	230-VDC.
(1)-40	P & H	50′ 0″	230-VDC.

230-VDC. CRANE & MILL MOTORS

H.P.	Make	Type	R.P.M.
(1)	P & H	5¼ x 3½	850
(1) 2½	G.E.	C.O. 2502	800
(1) 3½	G.E.	C.O. 2503	800
(1) 2	Shaw	B.E.	930
(1) 2½	Rel.	T	1600
(8) 2¼	Westg	K-1	835
(3) 6	G.E.	C.O. 1805	1150
(2) 7½	Westg.	MT-000	
(1) 8	Shaw	Z- #62	640
(1) 10½	C.W.	#6-K	810
(9) 20/30	G.E.	M.D. 104	725/575
(2) 19	Westg.	K-5	550
(14) 30/45	G.E.	M.D. 104½	625/500
(2) 50	Shaw	Z	550
(2) 50	G.E.	C.O. 1810	550
(1) 60	Westg.	K-10	470
(3) 65/85	G.E.	C.O. 1830	700/650
(2) 55/65	Westg.	MCA- #60	550
(2) 65/85	G.E.	C.O. 1811	700/550
(1) 60/80	G.E.	M.D. 106	550/475
(With Back Axle Brackets)			
(1) 100	G.E.	C.O. 1812	700
(1) 150	Westg.	MCB	365

Complete Resistors & Drum Controllers with Above G.E.M.D. Motors, Also 75 E. C. & M. Dinky, C.H., G.E., & Westgahe Drum Controllers in Stock 5 to 100-HP.

ELECTRIC TRAVELING GANTRY CRANES

(1)-3-ton Milwaukee 3-motor, A.C. or D.C., 31′ 3″ span, 13′ 3″ overhand each side.
(1)-15/5-ton McMyler, 4-motors, A.C. or D.C., 80′ 0″ span, 35′ 0″ lift.
(1)-50-ton Morgan, 5-motors, (2-25-ton trolleys), 60′ 0″ span, 50′ 0″ overhang each end.

GENERAL PURPOSES 230-VDC. MOTORS

H.P.	Make	Type	Speed
(2) 2	Al. Ch.	#50 DE	1750
(1) 3	Rel.	T-224	3500
(1) 3	G.E.	RLC-111	500/1500
(4) 5	Westg.	SK- #40	850
(1) 5	Westg.	SK- #33	1150/1650
(3) 7½	Westg.	SK-83&103	400/1600
(4) 7½	Westg.	SK- #60	850
(1) 7½	Westg.	SK- #40 (110-V)	1150
(1) 8	Westg.	SK-100	300/1200
(1) 10	Westg.	SK-50	1300
(2) 10	Westg.	SK-70	850
(1) 10	Westg.	SK	400/1600
(1) 15	Rel.	23-OT	300/1200
(1) 25	Westg.	SK	1100
(1) 70	Rel.	46-I.T. (New)	600/1200
(New E. C. & M. Auto. Panel)			

SLIP RING MOTORS

H.P.	Make	Type	Current
(2) 5	G.E.	MTC-5200	220/3/60
(1) 5	G.E.	MTC-5201	220/3/25
(1) 15	G.E.	ITC-5008	220/3/60
(2) 15	G.E.	ITC-5009	220/3/60
(1) 15	G.E.	MTC-5302	440/3/60
(3) 22	G.E.	ITC-5009	220/3/60
(2) 22	G.E.	ITC-5010	220/3/60
(1) 25	G.E.	MQC-5526	220/2/60
(1) 25	Westg.	C.I.	220/2/60
(2) 35	Westg.	C.I.	220/2/60
(2) 37	G.E.	ITC-5011-A	220/3/25
(1) 40	G.E.	ITC-5012	220/3/60
(1) 52	G.E.	ITC-5013	220/3/60

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1—3000 KW G.E. 600 V. Cond.
1—2500 KW G.E. 2300 V. Cond.
1— 625 KW Terry-Allis—600 V. Cond.
1— 500 KW G.E. 240 V. Cond.
1— 500 KW G.E. 2300 V. Mixed P.
1— 500 KW G.E. 600 V. Cond.
1— 175 H.P. G.E. Turbine—only.

AIR COMPRESSORS

1—1214 Cu. Ft.—Sull Angle 100#.
1— 782 Cu. Ft.—IR—55#.
1— 146 Cu. Ft.—IR—3 stage Belted. 1200#.

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1—500 KW. G.E. 550 V. 225—RPM.

G.E. CENTRIFUGAL COMPRESSOR

Type WM—675—8800/10800.
Volume—8800/10800 Pressure 32/39.6.
Driven by 820 H.P. G.E. Turbine.
Condition excellent.

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4—1000 H.P. Heine 250#.
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1—Duplex Steam—17″x10″x15″.
1—Duplex steam 12x7x12.

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1—126,000 CFM to 210 HP Turbines.
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3 Single phase, 2300 Volt Transformers 1—DC and 1—AC panel for above.

2—1000 KW., Westinghouse compound interpole 250 volt DC, 6 phase, 60 Cycle AC Rotary Converter 900 RPM.
2—Banks of 3 Single phase, 2300 volt transformers for above and 2—DC and 2—AC panels.

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SLIP RING MOTORS, 3 PH., 60-CY.

HP	Volts	Make	Speed
700	2200	G.E.	900
400 (2)	440	Whse.	514
350	220-440	G.E.	1800
350	2200	G.E.	600
300	2300-4000	G.E.	1200
250	440-550	G.E.	600
200	2200-550	G.E.	1800
200	2200-440	G.E.	600
150	440-220	G.E.	1800
150	2200	G.E.	900
150	2200-440	Whse.	1800
150	550-2200	G.E.	1800
125	440-220	G.E.	600
100	550-2200	G.E.	720
100	440-220	G.E.	1800
100	220-440	G.E.	720
100	220-440	G.E.	900
75	220-440	G.E.	600

SYNCHRONOUS MOTORS, 3-PH., 60-CY.

600	2200	Whse.		900
400	440-220	Whse.		276
1—350	440-220	G.E.		900
350	440-220	G.E.		200
240	2300-440-220	G.E.		600
200	2300-4000	G.E.		1200
	150	2200	G.E.	1800
	100	440-220	G.E.	1200

TRANSFORMERS—60 CYCLE

3—667 kva., G.E., 2300/4000-460/480 Volts.
3—667 kva., Whse. 22000-2300.
3—500 kva., Whse. 22000-2300.
3—350 kva., G.E., type H-KD 13200-2300.
3—333 kva., G.E., type H-KDD 2400-460/230.
3—250 kva., Whse. 13,800-460.
3—200 kva., G.E., type H 10000-600.
3—200 kva., G.E., H-KD 6600-2300/4000Y., 25 cy.
3—175 kva., G.E. 4000-480.
3—150 kva., G.E., type H-KDD 13200-2300.
3—150 kva., Al. Chal., type OISC 10400-2400.
1—100 kva., Pittsburgh, type OISC 2400-240-120.
3—100 kva., G.E., type H 2400-240/480.
3—100 kva., G.E., type H-KDD, 6900/11950Y-230/115.
3—100 kva., Whse. 22,000-2300.
2— 75 kva., G.E., type HK, 2300-230/115.
3— 50 kva., Moloney, 2300-230/115.
6— 50 kva., Whse. type SK, 13800-240/120.
3— 50 kva. Whse. 22,000-2300.

A.C. GENERATORS

1—500 kva., 900 r.p.m., 2209 V. Whse. Condenser.
1—312 kva., 900 r.p.m., 2300 V., Westghse.
1—300 kva., 900 r.p.m., 240/480 V., G.E.
1—225 kva., 600 r.p.m., 2200-240-V., G.E.
1—187 kva., 900 r.p.m., 2200-550-V., Westghse.

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
500	440/220	G.E.	IK	1200
500	440/220	G.E.	IK	900
400	2200	Whse.	C.S.	1800
50	2200	G.E.	IE-K	1800
250	2200	G.E.	I-K	600
200	220/440	G.E.	IK	720
150	2200	Allis. Ch.	AN	450
100	2200	G.E.	IK	600
100	2200	G.E.	IE-K	1800
100	550	G.E.	KT	900
100	220/440	G.E.	KT	720
75	2200	G.E.	KT	900
75	2300	G.E.	IE-K	1800
50	220/440	G.E.	K	1800

MOTOR GENERATOR SETS

2—200 KW 125 V. 900 RPM Whse. Con. to 300 HP 2200 V. 3 Ph. 60 Cy. Ind. Motor. Also
1—100 KW 125 V. 900 Rpm GE Con. to 150 HP 200 V. Ph. 60 Cy. Ind. Motor.
1—75 K.W., 250 V., 1800 R.P.M., Cr. Wh., Type CCD con. to 100 H.P., 2200 V., 3 ph., 60 cy.
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7500 KW 5000 V 60 CY 3 PH TURBO WITH SURFACE COND
Heat Exchanger 606 tubes 1¼ x 9' 6" long.
1500 CFM 2 STAGE AIR COMP. 275 HP. SYN. MOTOR DRIVE.
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Traveling Crane 75 ton Case, 64' span, 3 Motors.
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2—150 HP. HRT BOILERS and Stack.

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MODERN 1000 H.P. POWER HOUSE

WITH: 5-150 HP H.T. BOILERS, A.S.M.E., 150# PRESSURE INDIVIDUALLY COAL FIRED, with DETROIT UNDERFEED STOKERS, HOPPERS, AUTOMATIC ASH REMOVER, PUMPS, ENGINES, STACKS, GAUGES, etc.

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1—180 H.P. **Allis-Chalmers**, Horiz. 2-Cylinder 16" x 24" Full Diesel Direct Connected to 156.5 Kva. 3/60/2300-Volt Generator.
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All Ready for shipment—Kansas City. Write

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2—600 Cu. ft. Diesel Compressors
2—500 HP. AC Engine Diesel sets
Other smaller Diesel sets
1—15 ton Locom. CRANE, 50' boom
2—250 HP. BOILERS 160#, guaranteed

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50 ton hoist (electric)
8200 sq. foot surface condenser.

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50,000 gal. Tank on 100 ft. Tower.
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1,000, 5,000 & 10,000 BBl. Oil Tanks.
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8 H.P. G.E., 230 V. D.C. 810 RPM
8 H.P. C-W, 220 V., 535/1070 RPM
10 H.P. G.E. shunt wound, 230 V. D.C., 650 RPM
10 H.P. A.C. inter. duty, 220 V. D.C., 500/1200
10 H.P. Triumph shunt wound, 230 V. D.C., 760 RPM
13 H.P. Westg. #8 Type S, 220 V. D.C., var. speed, 375/750 RPM
15 H.P. Westg., 220 V. 500/100 RPM
42/50 H.P. West. 220 V. D.C., variable speed 500/1000 RPM, shunt wound

HOIST MOTORS

2—50 H.P. Ft. Wayne Elec. Co. Type "K", 600 RPM, 220 V. D.C.

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40 KW G. E. Type MP 110 V. D.C., belt drive, 860 RPM, 360 amps.
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300 H.P. Buckeye Diesel Engine & Gen. 3/60/240.
500 KW G.E. Skinner Uniflow Steam Eng. Gen., 250 V. D.C.
100 KW G.E. Type ATB-2-1250-3600 Form T, 814 amps, 3/60/2200-900 RPM
500 KW Turbo Generator, 3/60/2300 3600 RPM, 185# W.P.
POWER PLANT—Complete with two 625 KW Turbo Generators 3/60/2300, complete with 309 H.P. each Heine Water Tube Boilers, 225# steam pressure

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20 H.P. Howell, 3/25/440, 750 RPM
20 H.P. Westg. Type CCL, 3/60/220, 850 RPM
20 H.P. Gen. Elec., 3/60/400, 900 RPM
25 H.P. A.C., 3/60/220, 1200 RPM
25 H.P. West. Elec., 3/60/440, 865 RPM
25 H.P. Gen. Elec., 3/60/440, 1200 RPM
30 H.P. Westg., 3/60/220, 1800 RPM
30 H.P. Westg., 3/60/440, 840 RPM
30 H.P. Gen. Elec., 3/60/440, 900 RPM
30 H.P. Gen. Elec., 3/60/440, 870 RPM
35 H.P. West., 3/60/440, 800 RPM
37½ H.P. Lincoln Vert., 3/60/220, 1200 RPM
40 H.P. Gen. Elec., 3/60/440, 1200 RPM
40 H.P. Gen. Elec., 3/60/440, 900 RPM
40 H.P. West. Elec., 3/60/200, 1140 RPM
40 H.P. Gen. Elec., 3/60/440, 870 RPM
40 H.P. Westg., 3/60/440, 870 RPM
50 H.P. Howell, 3/60/440, 900 RPM
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35 KVA West. MG Set Motor:—40/90 HP. Type SK 230V. 800/1800 RPM. Generator:—35 KVA 3 ph., 40/90 cy. 115 volts, 800/1800 RPM. Late type Factory built.

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200 H.P. G.E.—TS—514 RPM.

SLIPRING MOTORS

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200 H.P. G.E., 720 RPM.
200 H.P. G.E., 514 RPM.
125 H.P. Burke, 600 RPM.
75 H.P. West., 1200 RPM. (5).
64 H.P. G.E., 585 RPM.
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60 H.P. West., 290 RPM.
(180 additional slipring motors, 1 to 50 H.P. in stock.)

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200 H.P. G.E., 600 RPM.
150 H.P. G.E., 600 RPM.
100 H.P. Cr.-Wh. 1800 RPM.
75 H.P. West. 1800 RPM.
60 H.P. G.E., 1800 RPM.
50 H.P. Allis Ch., 720 RPM.
50 H.P. G.E., 720 RPM.
50 H.P. G.E., 600 RPM.
(310 additional squirrel cage motors in stock, ¼ to 50 H.P.)

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200 KW G.E., 600 RPM.
150 KW G.E., 900 RPM.
150 KW G.E., 720 RPM.
100 KVA Cr. Wheeler, 900 RPM.
100 KVA West., 600 RPM.
90 KW G.E., 900 RPM.

230 VOLTS D.C. MOTOR GEN. SETS

150 KW G.E. 900 RPM.
125 KW Curtis, steam turbine.
30 KW West. 1750 RPM.
(18 additional sets in stock, 1 to 25 KW.)

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100 KW. West. 1200 RPM.
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50 KW West. 850 RPM.
(19 additional 125 V. M.G. Sets in stock, ½ to 25 KW.)

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100 H.P. Reliance, 1150 RPM.
60 H.P. G.E., 1050 RPM.
60 H.P. Roth, 600 RPM.
50 H.P. G.E., 850 RPM.

230 VOLT D.C. MOTORS

40 H.P. El. Dyn., 1450/2600
40 H.P. G.E., 1700 RPM.
40 H.P. Allis Ch., 1150 RPM.
40 H.P. Reliance, 625 RPM.
30 H.P. West., 500/1500 RPM.
25 H.P. G.E., 1150 RPM. (3).
25 H.P. West., 850 RPM. (2).
25 H.P. G.E., 575 RPM.
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(235 additional motors, ½ to 20 H.P. in stock.)

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90 H.P. G.E., 900 RPM.
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10 H.P. F.-M., 1150 RPM.
10 H.P. West., 850 RPM.
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7½ H.P. West., 1150 RPM.
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(115 additional 115 volt D.C. Motors, ½ to 5 H.P., also in stock.)

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Complete with exciter, main panel board, and automatic voltage control.

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Oil Burners Installed by Petroleum Heat & Power Co.

1—160 KW Gen. Elect. 3 Ph/60c/220V /220 RPM Generator Connected to:

1—20x20 Harrisburg Fleming 4 Valve Engine. With:

1—12 KW. DC. Exciter

Complete Switchboard with all necessary Instruments.

Worthington Feed Boiler Pumps—Duplex

Breachings & Steel Smoke Stack 110 ft. High

Vacuum Pump, Motor Driven

Sump pump, motor driven

1—Kelly-Patterson Hot Water Heater with copper coils

1—Worthington Open type Water Heater good for 1000 HP

All Pipings, fittings, valves, & header

All Non Return Valves, Bends to Header, and everything pertaining to make up a complete power plant.

Have all data when material was purchased

Wanted:

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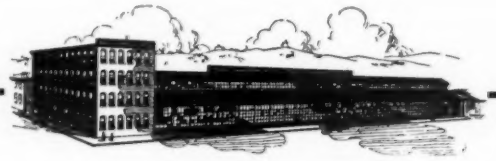

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1—125 KW 125 V. West'h. d. c. to 15"x16" Skinner, 250 RPM
1—150 KW 250 V. G. E. (W-E) d. c. to 16"x20" Ball, 4 valve, 200 RPM
1—150 KW 125 V. Triumph d. c. to 14"x36" Rice & Sargent, 4 valve, 150 RPM
1—200 KW 125 V. Triumph d. c. to 16"x36" Rice & Sargent, 4 valve, 150 RPM
1—200 KW 125 V. G. E. d. c. to 15 & 25"x20" Tandem Compound Skinner, 210 RPM
1—200 KW 250 V. G. E. d. c. to 18"x24" Chuse Corliss, 200 RPM
1—300 KW 125 V. Triumph d. c. to 22"x36" Rice & Sargent, 4 valve, 125 RPM
2—300 KW 250 V. Elliott d. c. to 21"x28" Elliott, 4 valve, 165 RPM
1—150 KW 2300 V. 3 ph. G. E. d. c. to 14"x36" Rice & Sargent, 4 valve, 164 RPM
1—150 KW 240 V. 3 ph. G. E. d. c. to 16"x18" Erie Ball, 4 valve, 225 RPM
1—200 KW 480 V. 3 ph. G. E. d. c. to 16"x36" Rice & Sargent, 4 valve, 164 RPM

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FREIGHT ELEVATORS
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WATERTUBE BOILER

Watertube Boiler: ASME Standard, 207 psi., 560 F., 5220 sq. ft., 4-drum ring-circuit Stirling type; installed 1927; Firite spreader stoker, 11 ft. x 9 ft. 6 in. grate; installed 1937; Elesco superheater installed 1935; Vulcan sootblowers, Copes feedwater regulator, Lunkenheimer non-return valves; first-class condition, operated 50,000 hrs., during past 7 yrs. used only every 6 mo. while larger boiler was cleaned and inspected; location midwest.

FS-504, Power
330 West 42nd Street, New York, N. Y.

FOR SALE

One 100 K. W. 250 volt D. C. Turbo Generator Turbine-Curtis Form C, 2 stage 3600 R.P.M. 150# S.W.P.
Generator—100 K.W. General Electric Type MFC, Class 4-100-3600 Form T, 400 Amps. 250 volts D.C.

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Must move immediately

6—600 H.P. Stirling W. T. Boilers with Harrington Stokers. 3—8x200 Steel Stacks, feed water heaters, pumps, piping, valves. Ash Handling Equipment, all boiler trimmings, draft fans. Plant complete, located Western Pennsylvania. Will sell all or part.

Stokers available immediately

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FOR SALE

PUMPS

2—LeCourtenay Pumping Sets, each consisting of two single-stage centrifugal pumps connected in tandem and mounted on a common base with Westinghouse synchronous motor. Each pump set rated 2700 GPM at 170 ft. total head. Each motor rated 150 h.p., 1200 RPM, 440 Volts, 3 phase, 60 cycles, 80% P. F. and with manual control panels.

Spare impellers and other parts included.

1—Elliott 14 inch Type P Twin Strainer, used few months only.

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Power plant equipment. Steam, Diesel, electrical, boilers, engines, turbines, generators new or used.

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FOR SALE:

One (1) Cochrane Open Type Boiler Feed Water Heater of approximately 25 H.P. and equipped with trays.

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POWER EQUIPMENT FOR PROMPT SHIPMENT

(3 ph. 60 cy.)

HP	Make	Volts	Speed	Type
700	G.E.	6600	1800	
450	West.	2200/220/440	600	CS
400 (5)	West.	2200/220/440	500	CS
350	West.	2200/220/440	500	CS
200	Al. Ch.	2200	600	
150	West.	220/440	580	CCL
125/40	Cr. Wh.	2200	700	125 AQ
125	Cr. Wh.	2200	700	125 AQ
100	Burke	220/440	900	
100	F. M.	220/440	600	BB

DC SERIES WOUND MOTORS

HP	Make	Type	Speed
15	West.		650
25	Shaw		600
30	G.E.	CO2002	610
35	Cr. Wh.	SM	565
50	Shaw		600
75	G.E.	211 Int.	550
100	G.E.	MD 108	480
130	G.E.	CO 1812	550
175	G.E.	MDS 190¼	475

SYN. MOTORS, 3 ph. 60 cy.

HP	Make	Volts	Speed
300	Al. Ch.	2200	600
75 (2)	G.E.	2200	900

SLIP RING MOTORS (3 ph. 60 cy.)

HP	Make	Volts	Speed	Type
1000	Al. Ch.	440	235	
700	G.E.	2200	393	MT 432
300	G.E.	440	600	I-M
200	G.E.	2200	240	MT 412
150	G.E.	220/440	720	I-M
150	G.E.	220	575	I-M
125	Al. Ch.	2200	435	
100	Al. Ch.	220/440	575	
100	G.E.-25 cy.	220/440	500	MI-108

"Wound Rotor Motors" (3 ph. 60 cy.)

HP	Make	Volts	Speed	Type
200	G.E.	2200	600	I-L
150	G.E.	2200	600	I-L
125	G.E.	2200	600	I-L

OIL ENGINE DRIVE AIR COMPRESSOR

Chicago Pneumatic simplate valve type, NSO3 straight line 16½ & 11 x 18" capacity 492 cu. ft. displacement, 100# pressure, with air receiver and starting air compresor.

M-G SETS 3 ph. 60 cy. (Syn.)

150 KW G.E. Type HCC 6 Rotary Con. 250 v. DC 2200 or 4000 v. AC
150 KW West. 550 v. DC—2200 AC 1200 RPM
125 KW Cr. Wh. 250 v. DC—440 v. AC 1200 RPM
100 KW G. E. 550 v. DC—2200 v. 900 RPM
90 KW Al. Chal. 230 v. DC 2200 v. AC 900 RPM

SHOP HOISTS

1—1 Ton Euclid AC Hook type, floor control
1—3 Ton Euclid AC Monorail with push trolley
1—1 Ton Sprague 230 v. DC
2—2 Ton Sprague 230/500 v. DC Monorail
2—5 Ton Northern AC Monorail Hoists on 35' Cranes

In addition to the above, we have hundreds of other items in stock—kindly send us your inquiries.

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Pittsburgh, Pennsylvania

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Your Best Bet for

USED EQUIPMENT

25 ton Browning Locomotive Crane.
300 to 5000 KW Turbo Generator Sets.
100 to 1000 HP Diesel Generator Plants.
175 and 250 KW Uniflow Generators.
75, 125 & 200 KVA 257 rpm Generators.
125, 150, 250, 300, 500, 1000 HP Boilers.

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STEEL TANKS EXCELLENT CONDITION

1—10x30' **Horizontal Tank** located Carthage, Tenn.
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1—10x30 3 compartment horizontal **Welded Tank** with steel supports located Sweetwater, Tenn.
1—20x25 **Ver. Riv. Tank** located Sweetwater, Tenn.
1—20x30 **Ver. Riv. Tank** located Charlotte, N. C.
1—10x30 **Hor. Welded** with steep supports, located Trenton, Tenn.
1—10½x25 **Ver. Riveted** located Clarksville, Tenn.

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ROTARY CONVERTER

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6—400, 500, 600 and 750 HP. Taylor Retort Stokers.
3—520 HP. B & W Superheaters and Stokers.
5—604 HP. Babcock & Wilcox 200 lb.

We specialize in high pressure boiler fittings, Boiler-Supports Superheaters pop safety valves, blow-off valves, steel headers, steam valves up to 600 lbs. up to 24" in diameter, turbine and motor driven boiler feed boilers —high and low pressure pumps.

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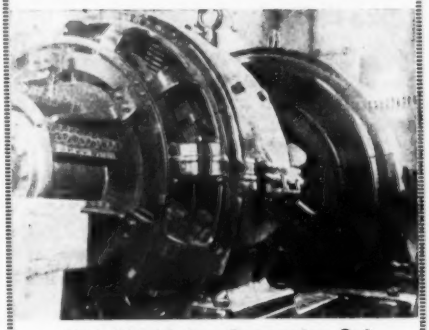

750 KW Motor Generator Set

code SEA 554 — 1—750 KW WESTINGHOUSE MOTOR GENERATOR SET: GENERATOR: 750 KW, D.C., 650 volt, 1,155 amp., 500 RPM. MOTOR: 1,020 HP, induction, constant speed, 3 phase, 60 cycle, 2,200 volt, type HF, 500 RPM.

SEA 8 — 2—50 KW WESTINGHOUSE MOTOR GENERATOR SETS: GENERATORS: 50 KW, D.C., 125 volts, 400 amps., 690 RPM. MOTORS: 75 HP, induction, constant speed, 3 phase, 60 cycle, 400 volt, type CCL, 690 RPM.

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Worthington, horizontal, three-stage, steam-driven. Formerly used for CO_2

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WHAT DO YOU REQUIRE?

SPECIALS

2000 KW Turbo-Generator, 60-3-480 V. Surface Condenser, Reconnect 600 V.—2300 or 4000 V. Rewind in 5 Weeks
1500 KW-Non Cond. Turbo Generator Unit 3600 RPM
5000 KW otherwise as above, except 2300/4000
3500 KW Turbo 60-3-2300 V. Jet Cond.
2500 " " " " Surface Cond.
1500 " " " " Jet Cond.
1250 " " " " Jet Cond.
1000 " " " " Surface Cond.
750 " " " " Surface Cond.
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Boilers 4—1000 HP., 4—750 HP., 2—500 HP., 4—560 HP.

Also Smaller Water Tube & Fire Tube Boilers

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3—Oil Well 90 H.P. 200 lb. working pressure fire box boilers.

3—110 H.P. 250 lb. working pressure Locomotive fire box boilers.

2—125 H.P. 350 lb. working pressure Locomotive fire box boilers.

2—Complete Sand Batch Hoppers with Link Belt conveying equipment.

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SYNCHRONOUS MOTORS

3 ph, 60 cy, Self Exciter

		Make	Type	Volts	RPM
6.3	KVA	G.E.	ATI PB	220	1200
40	HP	West.	P.F. 65%	220	1800
100	KVA	C.W.		240	900
3—125	HP	Ideal	Unity PF	440	300
130	HP	G.E.	ATB-PB	220/440	600
150	HP	G.E.	ATB-PB	2300	900
225	KVA	G.E'	AT17644	440	720
2—250		West.		440	1200
300	KVA	G.E.	ATB	600	600

SLIPRING

3 ph, 60 cy

HP	Make	Type	Volts	RPM
2—250	G.E.	IM	440	514
200	G.E.	IM	440	600
150	G.E.	IM	2200	720
150	G.E.	IM	440	600
75	G.E.	MT547	220	1200
75	G.E.	MT343	220	1700
75	G.E.	MT343	440	1200
60	Ideal	AVA351	440	600

D. C. CRANE & HOIST MOTORS

Qu.	HP	Make	Type	Volt	RPM
2	125	G.E.	CO1832	230	675 series
2	100	G.E.	CO1831	230	675 series
1	65	G.E.	CO1811	230	600 series
1	40	West.	K10	230	525 series
3	40	West.	K9	230	575 series
1	35	Northern	KF	230	800 series
1	30	P & H	12x8	230	420 series

D. C. CRANE & HOIST MOTORS—Continued

1	13	Niles	48C	230	285 series
2	10	West.	HK	550	800 series
1	6	P & H	8x10	110	600 series
2	7½	West.	K4	115	1000 series
1	25	Electro Dynamic		230	550 series wound crane with brake ball bearing
2	10	West.	HK	230	1100 DC
2	7½	G.E.	COm 1805	115	850

SPECIALS

No. 48 Gould Centrifugal 600 gpm 50 ft. head 1750 rpm.

No. 5 Cameron Centrifugal 600 gpm 100 ft. head. 30 HP West. SK 230 volt 1750 rpm spd—factory built.

Fairbanks Morse 860 NE 25 HP F & M H 12B 2300 volt 1800 rpm 3 BB—factory built.

Size No. 6 Morris Machine Centrifugal pump 123336.

Worthington Centrifugal pump 2 stage. 40 HP West. 220 volt 1800 rpm 3 phase syn. motor 65% P. F. dir. conn. exciter—factory built.

1—Worthington Centrifugal pump 3250 gpm 170 ft. head driven by 200 HP GE. 1E13B 2300 volt 1800 rpm squirrel cage.

1—Worthington 2 stage pump 350 gpm 240 ft. head driven by 40 HP West. synchronous 220 volt 1800 rpm 3 phase motor with direct connected exciter.

5—100 KW G.E. type CDM 250 volt 850 rpm compound wound.

1—2000 amp. Condit 3 pole single throw oil breaker 600 volt with handles.

We build motor generator sets, gasoline driven generator sets, and other special equipments.

ALL EQUIPMENT LISTED AVAILABLE FOR DELIVERY ON SHORT NOTICE.

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12TH AVENUE & 37TH STREET
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STEAM TURBINE

For Sale By Owner

Allis Chalmers—2500 KVA—3 Phase 440 Volt 60 Cycle Turbo Generator Set. Steam Pressure 150-185# — complete with Jet Condenser and Modern Switch Board—One Motor Driven Exciter and one Steam Driven Exciter. This Unit Is In Excellent Condition.

West Oregon Lumber Company

P. O. Box 6106 Portland, Oregon

MULTI SPEED MOTORS

3 phase 60 cy. 220 V. 18/1200/900/600 speed motor
1—4½ H.P. Century type S.C. frame SCM-19-SBB ball bearing motor
1—7½ H.P. Century type S.C. frame SCM-27-SBB ball bearing motor
1—4½ H.P. General Electric K.T. sleeve bearing motor
1—7 H.P. General Electric type K-T. model #43431 form C sleeve bearing motor
1—4½ H.P. General Electric type K.U.-859 form C.A. sleeve bearing motor
1—7½ H.P. General Electric type K.T. 523 form B.L. sleeve bearing motor

Suitable drum controllers available for operation with above motors

R. SCHEINERT & SON

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2—Westinghouse A.C. Turbo Generators, 1560 K.V.A., 1510 amps. per Terminal, 600 Volts, 60 Cycle, 3 Phase, 3600 R.P.M., Serial No. 159-11259, directly connected to

1—Westinghouse Turbine, No. 3182; 3600 R.P.M., Serial No. 97, mixed flow regulator.

1—200 Ampere Oil Switch, Manual Operated and Switchboard Panel.

1—West Surface Condenser, 4200 square feet, Serial No. 871, Circulating Air Ejector, Condensate Pump.

REPUBLIC TEXTILE EQUIPMENT COMPANY

40 Worth St. N. Y. C.

COMPLETE POWER PLANT

Expect offer complete 1437 KVA power plant for sale subject government regulations and prior sale about March 1, 1943. Consists of 3 Skinner Unaflow Engines with Westinghouse generators and exciters rated 1000 KVA 375 KVA and 62½ KVA, all 440 V—60 C 3 PH. Also include 2 H.R.T. Nu-way Boilers rated 255 BHP each with Whiting Stokers, etc. Plant operating open for inspection. Sell as entire unit.

La Crosse Rubber Mills Company

La Crosse, Wis.

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REBUILT 75 HP WESTINGHOUSE MOTOR, TYPE CW 220 V. 3 Ph. 60 Cy. 575 RPM Slipring Motor, Serial #4191747, complete with grids and non reversing controller.

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FOR SALE

500 HP 175#, Vogt Boilers, Chain Grate Stokers—Steam Pumps—Valves & Piping —833—25—15 KVA Transformers.

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BRASS PIPE & FITTINGS

(extra heavy)

2600# of 2", 3" and 5" sizes, consists of ells, tees, flanges, 45 degree ells, piping in full lengths and numerous nipples. All fittings removed, all in perfect condition and clean as new.

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FOR SALE

2—150 Kilowatt Ridgway Steam Engine Generator Sets. 1—200 Kilowatt Steam Generator Set. 2—Double Horizontal Danville Hoisting Engines, 6' drum, 125# steam pressure. 5 Boilers, 150 HP, size 72"x18', 125# steam pressure. 1—DC Sheppard Hoist.

The George M. Jones Co.

Glouster, Ohio

POWER PLANT COMPLETE

500 HP Sterling B&W 200#, 1928
Kenney Vansaur Pulverizing equipment
Cochrane, lime and soda, hot water unit
American steam duplex pumps
Smoke stack 160' x 6' x ¾"

Call Write Phone

Nat'l Boiler & Equip. Sales Co.

2732 No. Talbot Ave. Indianapolis, Indiana

FOR SALE

1—10-Ton Double I Beam hand Power Traveling Crane. 48' span 100' of runway.

LIGHT AND POWER DEPARTMENT Town house
TOWN OF HUDSON MASS.

All Shapes and Sizes!

THE refractory shapes needed to construct a furnace lining of fire brick or tile are as varied as the shapes on a public beach—and a lot harder to find. But every shape under the sun is readily formed when you use:

PLIBRICO
Jointless FIREBRICK

PLIBRICO eliminates all fancy tile and other special shapes. This moist, plastic material can be readily moulded to any shape or contour. It is ideal for repairing or rebuilding door openings, burner rings, arches, complete walls, etc. Within a few hours, you can have your boiler back in service again.

It's as if every carton of Plibrico contained an endless variety of special shapes—but far better, of course, because the finished Plibrico lining is completely free of the weak joints that cause breakdown, heat loss, and infiltration when laid-up fire brick is used.

The Plibrico idea of highest-quality refractory in monolithic form has made Plibrico Jointless Firebrick first choice of experienced operating engineers throughout the power industry. And today these basic advantages of Plibrico construction are multiplied by the fact that it eliminates all special shapes and is immediately available.

Where a castable material is desirable, we also offer Plicast refractories. This material is used for casting a reserve supply of special shapes in moulds; also for forming special shapes on the job.

Plibrico lining and suspended ignition arch in connection with spreader-type stoker; showing how Plibrico monolithic construction eliminates numerous special shapes and does away with trouble-making joints.

100 LOCAL STOCKS—Warehouse stocks are carried in over 100 cities in U. S. and Canada. Complete installation and boiler setting service is provided, or your own maintenance men can install Plibrico. Your local distributor will give you facts about Plibrico products and service. Or write for our big catalog; specify whether you want book covering H.R.T. or water tube boilers.

PLIBRICO JOINTLESS FIREBRICK CO.

Nation-Wide Boiler Setting Service

1818 KINGSBURY STREET, CHICAGO, ILLINOIS

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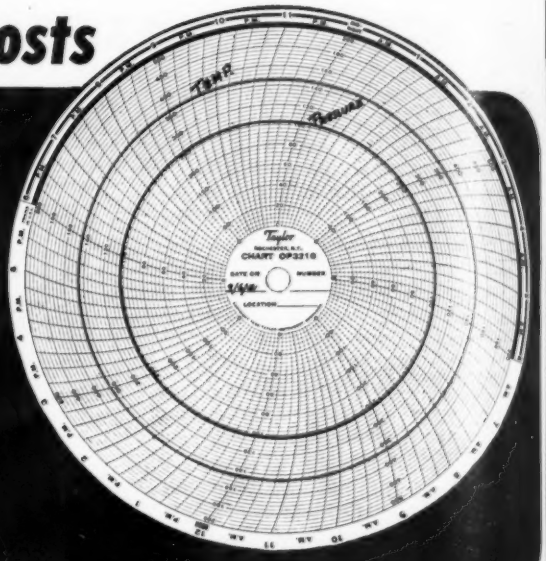
Cut Spoilage and Operating Costs

Swartwout Reducing and Desuperheating Station automatically assures uniform control of process steam

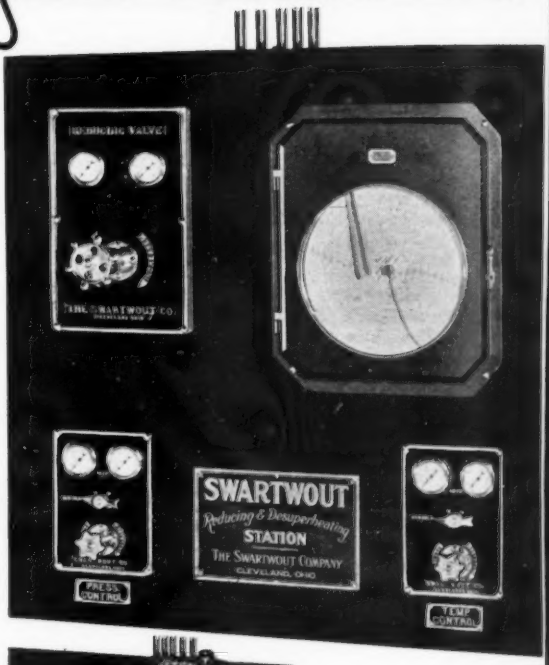


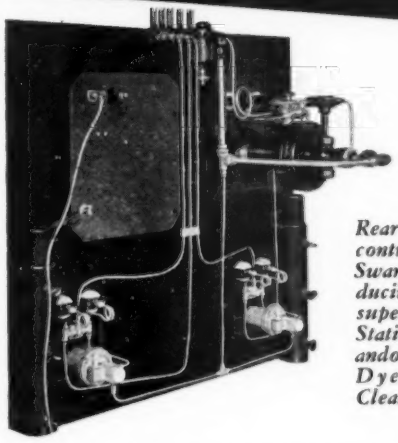
WHEN you want to be sure to hold pressure and temperature reduction "on the line" for important processes, plan for Swartwout Reducing and Desuperheating Control. Uniform results that spell economy and safety are achieved day after day in hundreds of plants by Swartwout Equipment.

The consistent performance recorded on the above chart means a great deal in time and money saved for Lewandos French Dyeing and Cleaning Company at Watertown, Mass. For wide variations in the quality of their process steam would mean costly spoilage and extra time for running work over. Their Swartwout R. & D, Station faithfully reduces steam from the high pressure to 105 lbs., 360° F., using a Type G Reducing Valve and Swartwout Carburetor Type Desuperheater.

Controls compactly grouped on the panel (at right) include Master Regulator for the Reducing Valve which can be readily set, manually; and manual controls for both pressure and temperature regulation. When set for a specific result, the station is completely automatic. Manual facilities provide convenient flexibility when desired.

When Swartwout assumes the *unit responsibility* of supplying properly related equipment, your entire problem of pressure and temperature reduction is solved with dependable guaranteed control. Swartwout design and painstaking manufacture—for 37 years—assure outstanding performance. *Write or phone for help on your steam control problems.*



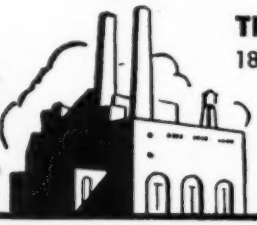


Rear view of control panel, Swartwout Reducing and Desuperheating Station at Lewandos French Dyeing and Cleaning Co.

Feed Water Regulators • Pump Governors • Feed Water Heaters
Master Controls • Reducing Valves • Separators • Exhaust Heads

Swartwout

•Power Plant Equipment•



THE SWARTWOUT COMPANY
18501 Euclid Avenue • Cleveland, Ohio

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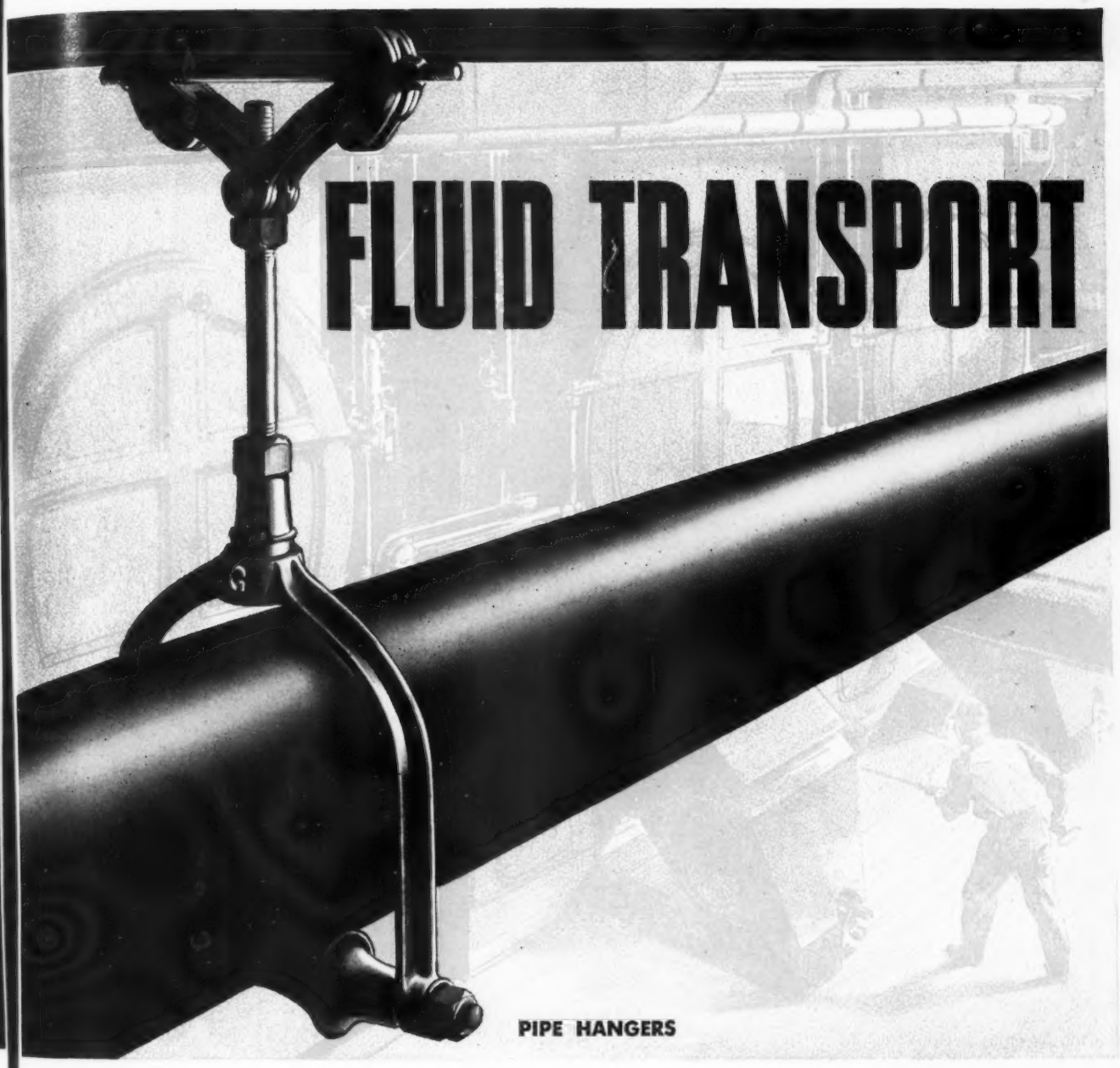
Controlled **AIR CIRCULATION**
for Power Plants and Industrial Buildings



"THE NORTH WING HAS STOPPED 'SQUAWKING'." It takes more than pipe alone to distribute steam for power, processing and heat to all the spots in a plant where steam is essential. It calls for experienced piping engineering to compensate for such factors as weight, pressures, exposures, expansion and contraction.

The distribution of steam is a job for Grinnell FLUID TRANSPORT. As fabricators and manufacturers Grinnell supplies the connecting links which convert a pile of pipe into a complete piping system.

For new war construction, or maintenance and repair of existing piping, call your nearby Grinnell branch. Grinnell Company, Inc., Executive Offices, Providence, R. I. Plants and offices throughout the U. S. and Canada.

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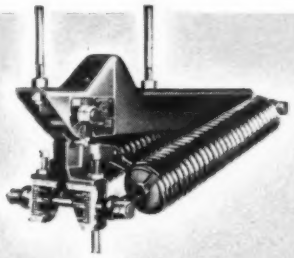
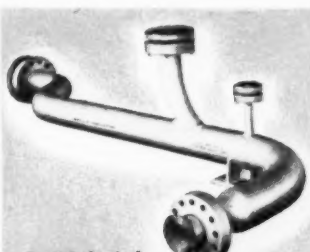
Automatic Sprinkler Systems



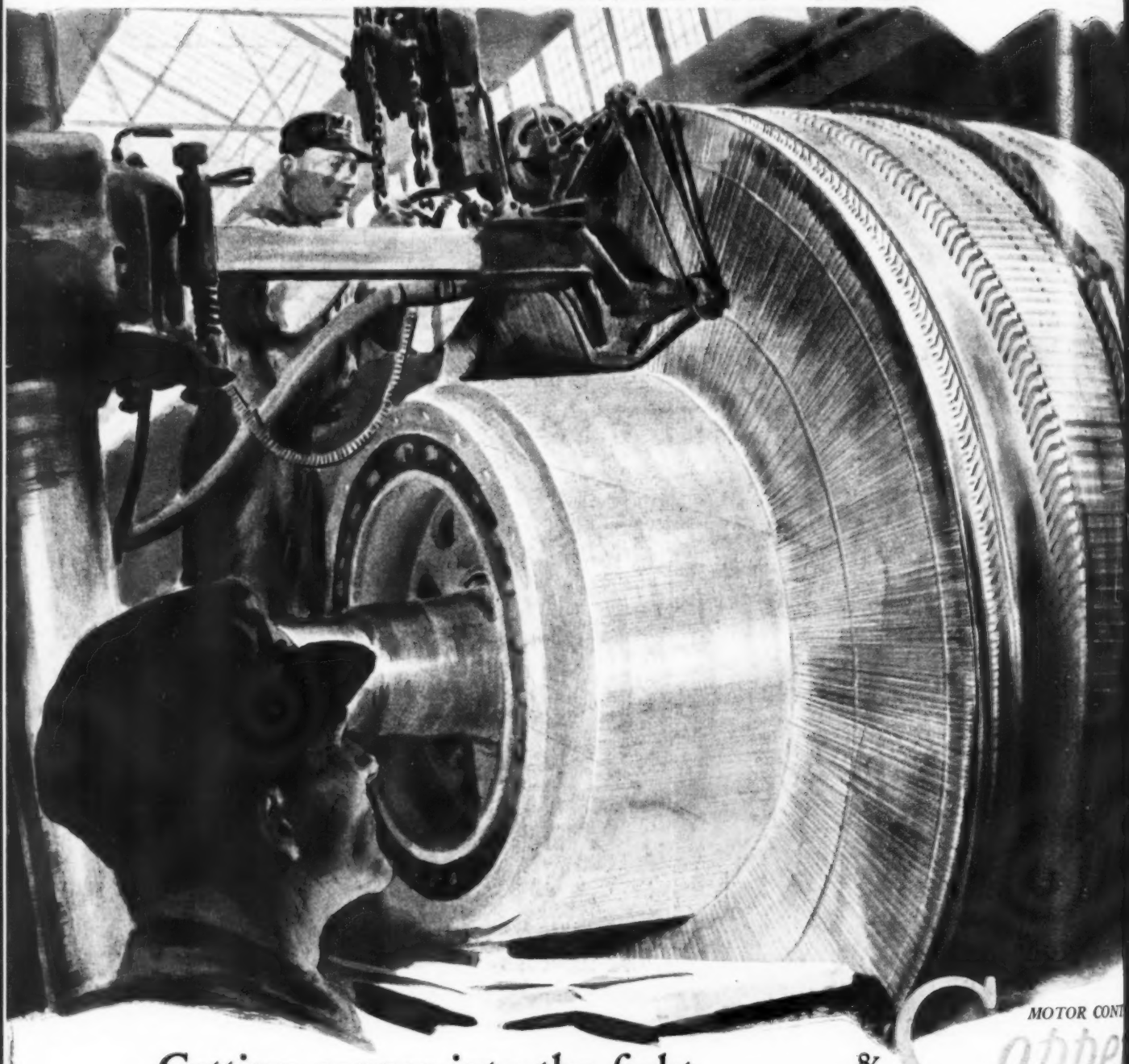
Genspring Constant-Support Pipe Hangers

Pipe and Tube Fittings



Prefabricated Piping

For the Power to Win



MOTOR CONT

& Copper

Getting copper into the fight is a full-time job for Motor Control

The important role electric power is assigned in helping win this war may well be judged by the significant unprecedented demand for copper. And this in itself is *double* proof of the nation's dependence on reliable motor control. First, motor control these days has to do an around-the-clock vigil on hundreds of operations to get copper from the mine to a finished product. And then, almost invariably, motor control has to accept an unending responsibility for the protection and proper use of the copper-built electrical devices it has helped create. Even before this war most men in Industry realized that motor control was too vital in function to be carelessly accepted. But under the demands of wartime production many are seeing proof of Cutler-Hammer dependability that will be reflected in buying policies for years to come. CUTLER-HAMMER, Inc., 1358 St. Paul Ave., Milwaukee, Wis. *Associate:* Canadian Cutler-Hammer, Ltd., Toronto, Ontario.

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CUTLER·HAMMER
MOTOR CONTROL
C-H

Motor driven drills make the blast

Motor driven shovels and muckers up the shattered ore-rock.

Motor driven conveyors lug ore to cr

Motor driven machines screen and the rock to sand.

Motor driven agitators separate particles from the wetted sand.

Motor driven drums clot the solids

Motor driven blades stir the dehy slime in the roasting furnace.

Motor driven cranes pour the load and unload the electrolytic baths.

Motor driven mills produce wires and tubes.

Motor driven shapers, cutters and form other needed shapes.

Motor driven sanders, polishers, etc., help in the final assembly.